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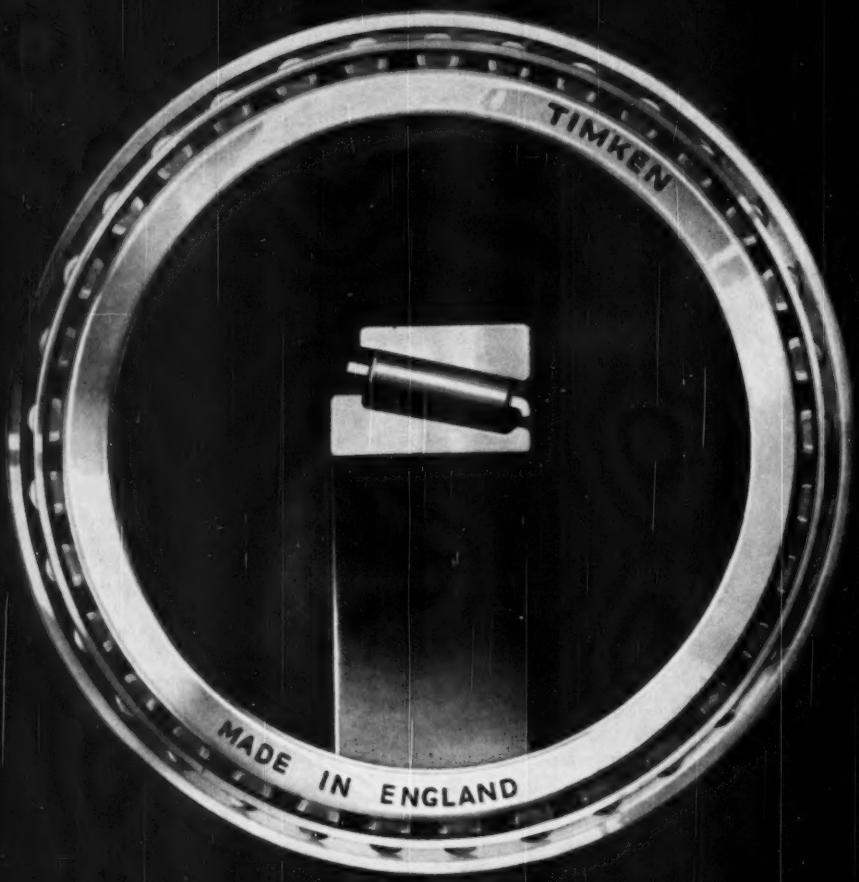

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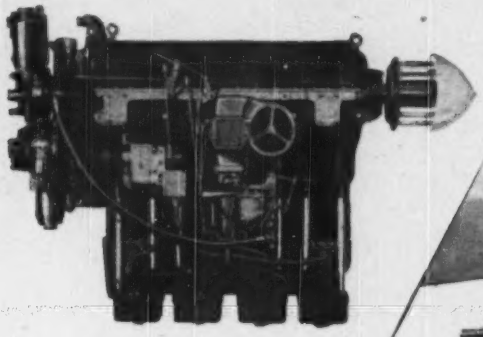

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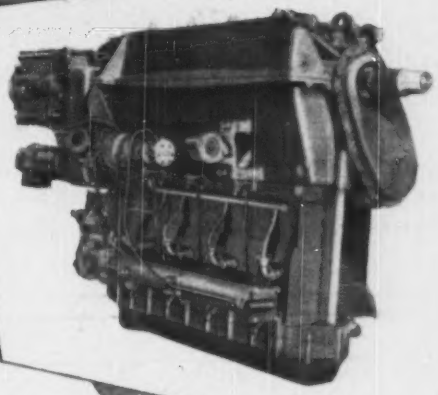

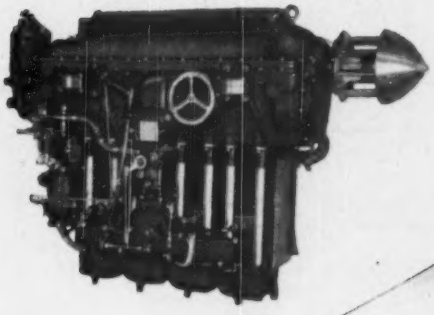

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Helicopter Enterprise

RELATIVELY little has been heard of B.E.A.'s small-scale but most significant and enterprising Helicopter Unit, which for more than two years has been gaining operational experience of day-and-night experimental flights and mail services. The first important trials took place in the West Country; later, day flights were made over roundabout routes in Norfolk from the base at Peterborough. Next followed night flights, and an experimental but regular night-mail service designed to demonstrate the possibilities to the Postmaster-General. The successful conclusion of this experiment, the first of its kind, led to a contract being granted for the first regular helicopter night-mail run in the world. Now comes the welcome announcement that B.E.A. intends to inaugurate on June 1st a day-time helicopter passenger service between Liverpool and Cardiff. Details are given on page 284.

After the war, America started well ahead of this country so far as equipment and experience were concerned, and still holds a considerable lead in the variety and number of helicopters flying; but Britain has managed to catch up and keep abreast in the matter of operational technique, and for this state of affairs the B.E.A. Helicopter Unit can take a great deal of the credit.

In America, the Civil Aeronautics Board is at present engaged in discussing various applications from would-be operators of helicopter services in and around New York, Cleveland, Chicago and other cities, and the success of the existing mail service in the Los Angeles area (also flying Sikorsky S.51s) was referred to in our issue of October 20th, 1949. A similar service has been authorized for Chicago.

It has been stated in America that "without active Government support through mail payments, a successful commercial helicopter service appears impossible at this time." Last week, however, two companies sought permission to operate commuting services between New York and its suburbs. Single-engined helicopters were claimed to be safe and suitable, exhaust silencers would be fitted, and inflatable pontoons would be provided in case of an emergency descent on water.

Thanks to B.E.A., this country will probably be first in the field with passenger services by helicopter. (No mail contracts have been mentioned.) This is a fitting climax to the pioneer work of the Helicopter Unit. What is now required to complete this enterprising picture is the appearance of all-British twin-engined transport helicopters to meet the needs which already exist or can be foreseen.

Showing America

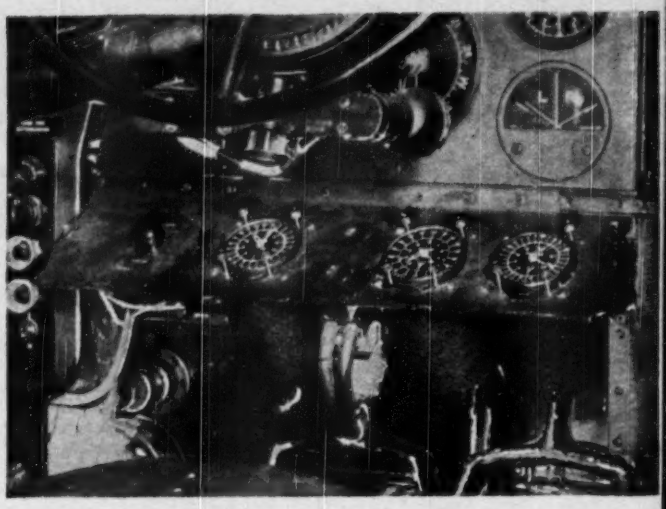
IT was most gratifying to learn that our leading article of December 1st—in which we advocated an immediate all-out sales drive for British aircraft, and the sending-out of new turbine-powered designs to "sell themselves"—was enthusiastically received in many influential quarters. We still believe that there is no time to lose if the country is to exploit what is at least a temporary lead over all comers in the building of jet and turboprop airliners, and for that reason we heartily approve the proposal to send, in answer to an invitation from the U.S. Society of Automotive Engineers, the Avro Jetliner, and even the D.H. Comet and Vickers Viscount, to America for demonstration. The visit is proposed for April, so notice is short in the case of the two prototypes from England, but a preliminary trip, even though it entails the crossing of the Atlantic, should not require nearly so much preparation as would a prolonged demonstration and sales tour. A recent flight of long duration by the Comet has confirmed its ability to fly with safety the North Atlantic by the normal B.O.A.C. route.

The more Americans to fly in the Viscount and to talk about their experiences afterwards, the better, we feel, will be its sales prospects. A little later on it will almost certainly be possible to say the same of the Comet; in spite of the remarkable progress made, April is probably too early to be giving rides in this airliner.

Difficult as it may be to break into the North American market, we do not subscribe to the opinion that it is irrevocably closed to British airliners.

TEST-FLIGHT NAVIGATION

Practical Experience with the Decca Navigator System in the Ambassador



In the Ambassador, the three miniature Decometer repeaters are immediately beneath the captain's blind-flying panel.

THE choice of navigational equipment and crew for aircraft test development work has always been a difficult one. If no special arrangements are made and the flying is carried out solely with the help of normal V.H.F., supplemented by pilot dead-reckoning, then the programme must be ruled by prevailing weather conditions, and high-altitude or long-period flying can only be planned on a day-to-day basis. If, on the other hand, crew and equipment are carried to permit regular all weather work, then this crew is surplus during periods when only local low-level test flying is necessary.

Obviously a position-finding and homing system which can be reliably operated by a normal test-flying crew is the ideal at which to be aimed. Airspeed have consequently adopted the Decca Navigator system and, after a period of preliminary investigation during which the system gave a very good account of itself, the equipment is now permanently installed in the second prototype Ambassador.

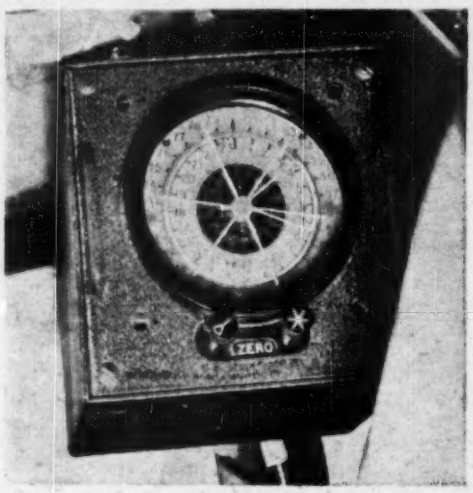
From the time when the Decca hyperbolic system of radio navigation was first introduced* *Flight* has consistently stressed its advantages and we take pleasure in reflecting that its use as an aid to test-flying was first suggested by ourselves. The principle of the system is now well known. Signals, emitted continuously from one master and three slave transmitting stations (which are phase-locked) form a "pattern" in space. The receiver in the aircraft picks up these signals and operates three meters, each of which indicates a number and fraction appropriate to position lines which can be seen on a special chart. These lines correspond to the lattice pattern formed by the transmissions and the reading of any two of the meters can thus provide a fix.

The meters are, in effect, counters of the in-phase lines through which the aircraft has passed. One needle on each meter shows a zero reading when passing an in-phase "lane" and fractions of the lane during its circuit of the dial, while a second needle counts the number of lanes crossed and drives a lettered disc indicating the zone. A fourth indicator, known as a lane identifier, is used to enable the meters to be set correctly in the first place, or to be checked at any time later. This lane identification meter automatically displays the check figure for each decometer in turn at minute intervals, and provides a continuously indicating master-instrument from which an approximate position can always be obtained whether the individual meters have previously been in operation or not.

Although a condensed description of this kind may give an impression of complication, operation of the system is really very simple and can be handled by a pilot alone. No tuning is required. The decometers and lane identifier are set to zero by small buttons on the peripheries of their dials before take-off, and afterwards the equipment will operate continuously so long as the aircraft is within the coverage of the system.

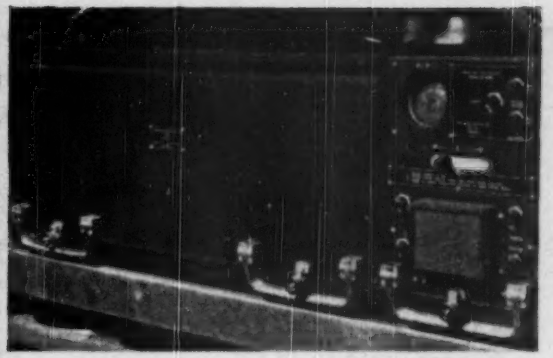
In order to obtain the position of the aircraft, the pilot takes the readings of two of the decometers and uses the figures to plot a fix on his chart corresponding to the intersection of the numbered lines. Each lane is divided into a hundred divisions on the appropriate decometer, so that a very high accuracy of fixing is possible within, say, three hundred miles of the London area. Satisfactory tracking information is, however, obtainable up to a range of 1,000 miles.

The smallest division on the "green" decometer is, in fact, equivalent to about twenty yards in the Christchurch area, but this standard of accuracy is required only when homing on an airfield. When homing, all the pilot needs to do is to fly to the particular lane which crosses his base airfield and then to steer his aircraft so that the needle on the appropriate decometer remains stationary. His progress along the homing lane will be indicated by the readings from one of the other two decometers giving the



By means of the Lane Identification Meter, initial settings of the Decometers can be made, and running checks of their readings automatically obtained at one-minute intervals.

**An explanation of the system first appeared in "Flight" for September 13th, 1945. Recent developments were described in an article in the issue of June 2nd, 1949.*



In the Ambassador, the standard Decca Mk VI airborne equipment is mounted on the starboard side of the radio operator's section. The dimensions are 27in × 8¼in × 10in, and the weight of the complete installation is 78 lb.

successive numerical values for the intersecting pattern.

It is relatively easy for the pilot of a large aircraft to plot his position on the normal Decca chart, but, as it may not always be convenient to do so, a flight plotter has been designed by the Decca Company to simplify the process. With this device, the readings from the decometers are manually set up on two scales which, by an automatic linkage, actuate a cursor on the surface of the chart and place it on the position of the Decca fix. The charts, which may be for air routes or for an area round an operating base, have circles of distance and QDMs-to-base drawn on them. Thus, when the cursor is on the fix, the pilot can at once read off all of the essential navigational information.

The Decca installation in the Ambassador is of the latest Mark VI type. The receiver is placed in the rack provided for radio gear; one set of decometers is in a position where it can be seen both by the radio operator (if one is carried) and the flight engineer; in addition, miniature repeater-decometers are mounted directly in front of the first pilot. For convenience, the lane identifier is mounted on the starboard side of the control cabin, where it can be seen from all seats. The equipment is operated from the normal fixed aerial, and dry-wick static-suppressors have been fitted to the wing tips and the tail unit so that the charge which an aircraft accumulates when flying through certain types of cloud and rain, and which may cause disturbance to the reception, is silently dissipated. The normal installed weight for the airborne equipment is of the order of 60 lb, but in the Ambassador duplicate decometers and other items are included (which would not necessarily apply to other aircraft) and this has brought the weight up to 78 lb. The power consumption is under 0.4 kW at 12.5amps.

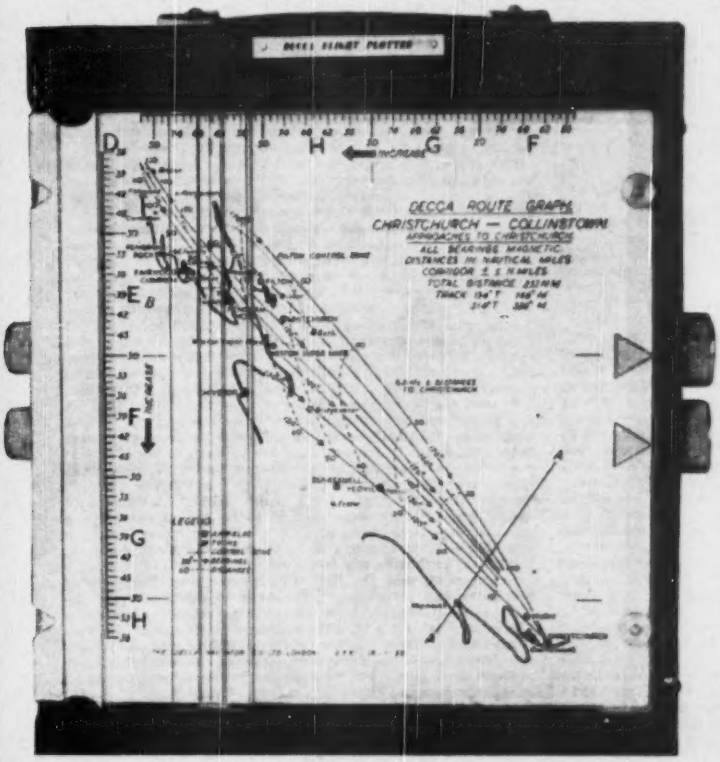
For Airspeed's own purposes a large chart has been prepared for use by the control tower at Christchurch. The pilot will from time to time pass his decometer readings to the control tower by V.H.F., and the personnel there will quickly obtain a fix and thus be kept informed of the aircraft's movements. If necessary they can pass back, by V.H.F., the position to the pilot.

During the Ambassador's recent demonstration visit to Eire, the Decca equipment was used exclusively, with V.H.F. as a stand-by. Since the Hurn-Collinstown (Dublin)-Shannon-Collinstown-Hurn legs were all flown above cloud, there were no opportunities for using, so to speak, a visual crib.

Changes of course were made firmly from Decca readings only. These changes included a six-degree alteration, while above cloud, within nine minutes of the take-off from Hurn, yet the let-down into Collinstown showed the course to be correct and the final fixing accuracy to be within three miles of the correct one—an error which confirmed previous calculations for a flight to this point, which is at the limit of the accurate coverage of the system. On the return flight—with the aircraft "entering" the system and heading for a position within a hundred miles of London—the let-down course and fix tallied exactly with the Hurn V.H.F. homer QDMs, and the decometer readings, after landing, were within 230 yards of the actual position.

On the flight from Collinstown to Shannon—which is beyond the accepted coverage of the present system and in an area where the red-green lattice cuts are very shallow (about 8 deg)—the equipment showed very fair results. At such extreme range the lanes are, in any case, not entirely stable, and the best let-down procedure would be that of homing on a lane crossing the airport, since the error would then not be greater than half a mile.

During the Hurn-Collinstown flights Decca was used to check the ground speeds between various points, and these



The Decca Flight Plotter is a case about 12in square in which is fitted the required route-graph chart. Decometer readings are translated against the top and side scales by means of the knurled buttons, the Perspex cursor thence giving the position-fix. The route graph shown is for the approaches to Christchurch (bottom right) from Collinstown, all relevant information being included in addition to Q.D.Ms and distances from destination.

TEST-FLIGHT NAVIGATION . . .

speeds showed a high order of accuracy when compared with the known T.A.S. and Met. winds on the various sections. In an area nearer to the transmitters, and flying a course across a close-packed lattice—say, along the South Coast—Decca should provide an extremely accurate means of checking ground-speed and consumption figures. Previous to the Dublin trip the equipment had already been used on pressurization tests up to a height of 20,000ft over cloud, and on one occasion it was used successfully for homing on a particular point of the coast after a descent through low cloud in gathering darkness.

In many ways the very first test of the equipment provided the most effective demonstration. Two multi-course circuits were flown above cloud on the automatic pilot. Each turning point proved to be correct after a descent for visual check, and on one sector an accurate let-down was completed after two turning-point had been passed in blind conditions. Safety checks were, of course, made throughout against V.H.F. bearings, but no alterations to course were required other than those demanded by the Decca fixes, and the final landing showed the references to be correct to within a few hundred yards. This, in spite of the fact that several continuous spiral descents had been made in the course of the flight.

At the present time, Saunders-Roe, Ltd., are making a trial installation of Decca equipment in a Sunderland with the object of establishing operating techniques for the use of Decca in the flight trials of the prototype Princess. The system has much to offer in this regard, so the hire charge of £350 p.a. seems reasonably low. This would apply even if the system was used for navigational purposes alone, but if it can be turned to account in establishing such things as A.S.I. position-error (by virtue of ground-speed measurement) and, also, unstick distances, then its value as a flight-test instrument will be greatly enhanced. Whether or not the equipment can be used in these connections depends on the prior determination of signal lane position in reference to known topographical features.

THE FUTURE of AIR-TRAFFIC CONTROL

Symposium of Papers Read to Institute of Navigation

MANY of the aspects of the increasingly complex problems with which civil aviation is today confronted were enumerated in a symposium of papers read before a meeting of the Institute of Navigation at the Royal Geographical Society in London on February 17th. Digests appear below.

THE CONTROLLER'S VIEWPOINT

IN a paper entitled "The Controller's Viewpoint," Mr. M. A. Young (an M.C.A. traffic-control officer) began with a brief history of the control organization in Britain from the days of its inception in 1920. He then showed how—particularly in Britain—the war had interrupted development of a control system, and how, when it ended, civil aviation had restarted with a miscellaneous collection of ground services. In the hope of early I.C.A.O. agreement on aids and procedures only the most urgent problems were tackled. Procedures had to be based on the inaccurate M.F. aids which were carried by most aircraft and were therefore far from ideal. The old adage of making bricks without straw could never be more aptly applied than to post-war control plans in the U.K. which, he said, were based on pre-war outmoded organization, some pre-war outmoded navigation facilities, a hodge-podge of communications, pre-war outmoded civil airports plus discarded military airfields in locations unplanned for civil operations, non-existent procedures and outmoded legislation. These facts, together with a reluctance to forge ahead until international agreement (with the eventual I.C.A.O. activities) assured a measure of progressive uniformity with adjacent countries, had provided the possible build-up to date.

In the United States, on the other hand, a system, used exclusively by English-speaking crews, was developed along logical and progressive lines using as its foundation a single equipment—M.F. four-course ranges. The speaker continued, "The smoothness of operation of such a uniform system with compulsory airborne equipment is unquestionable. That its present-day adequacy is not a matter for complacency, however, is recognized by those responsible authorities on the other side of the Atlantic. Incidentally, that such an obsolescent, if not obsolete, system is now being implemented extremely slowly in this country is not a prospect of which one could be very enthusiastic."

Mr. Young considered that the problem which must now be faced was that of traffic control in relation to aircraft which must attain a high cruising altitude as soon as possible after take-off and maintain that altitude for as long as possible commensurate with a semi-powered descent to a virtual straight-in approach. The picture was further complicated by the fact that, in spite of an ever-increasing tendency towards higher maximum cruising speeds, the 100 m.p.h. type of aircraft seemed for ever with us.

For the future, the speaker envisaged requirements as being firstly an accurate basic navigation aid providing complete area cover which would enable pilots to determine at any time their track, distance and time to run to any point in the area. Parallel tracks between terminals could be flown and the present large horizontal separations reduced without loss of safety. Routes would consequently be more direct and economical and there would be more flexibility in choice of cruising altitude and rates of climb and descent. The second requirement, he stated, was for an improved communication system. The pilot and controller should be in direct communication without intermediaries. To avoid overloading of channels all possible information should be passed by ground-to-ground links leaving air-to-ground channels for use only when the flight deviated from plan. He also emphasized the need for a radar monitoring function and the presentation of an intelligible picture to the controller. It was his belief, he said, that traffic problems resolved long before the aircraft arrived at their destinations would have a direct advantageous effect on the safe maximum utilization of runways at terminals.

NAVIGATIONAL ACCURACY

DR. G. E. BELL, of the M.C.A. Operational Research section, gave a *résumé* of many detailed observations obtained during the course of lengthy research into the study of the rate of traffic-flow at large airports. A consideration of the essential characteristics of this flow showed, he said, that it is not generally possible to draw up reasonable schedules for all aircraft and therefore the arrival pattern must be largely random. Some delays are inevitable, their magnitude depending on the arrival rate and the landing interval, but they could nevertheless be usefully reduced by speeding-up chosen aircraft by approximately 10 per cent for the last hour of flight, provided that the revised E.T.A.s were accurately kept. Accuracy of E.T.A. alone, although not directly reducing the delays, would considerably alleviate congestion near airports.

An extensive examination of the accuracy of navigation actually achieved by aircraft flying over South-East England (as observed with ground radar equipment) had shown that, in general, position-reporting accuracy in I.F.R. conditions was poor, the average error being of the order of six miles. It had been found that aircraft entering the Metropolitan Control Zone pass, on the average, about one mile from the entry beacon, but with E.T.A. errors of five minutes or more. About 15 per cent of aircraft near the beacons in I.F.R. were more than 500ft from their allotted height, the average error in straight and level flight being about 250ft. Overshoots of several hundred feet were noticed to be a common practice when aircraft were changing height. Near airports, accuracy was even less, particularly in turns, when the average loss of height was approximately 400ft.

It appeared, said Dr. Bell, that the required standards of height-keeping in relation to 1,000ft separations could be attained by current methods, since the majority of aircraft flew within acceptable limits, although the existence of a relatively small but important number observed well outside the acceptable limits, suggested a certain measure of careless flying. The present performance of the best 80 per cent was not good enough to permit altitude separations of 500ft, and it seemed that height-keeping with a standard deviation of some 200ft was about the limit possible with present practice.

The limited evidence available suggested, said the speaker,

that the present position finding was by no means good enough for control purposes, as apart from a surprisingly large number of aircraft which were really "lost," too many were observed many miles away from their stated positions until very near the reporting beacons (which were in congested areas). This situation would be eased, he thought, when the Airways Plan was introduced, because such a system would facilitate good track-keeping and provide more reference points.

The question of good time-keeping had been shown to be of paramount importance in connection with the smooth operation of airports. With landings taking place at five-minute intervals, as is the case at Northolt at present, E.T.A.s are required with an accuracy better than two minutes, while any improvement in the landing interval (and one of three minutes ought soon to be possible) would bring in stiffer requirements. With aircraft travelling along airways equipped with M.F. beacons at intervals of fifty miles or so, he considered that it should be possible to maintain E.T.A.s to within two minutes with reasonable care, but the high accuracies necessary for really smooth operation around airports were outside the capacity of the normal M.F. facilities, and demanded navigation aids of high precision.

For the future, Dr. Bell considered that a highly accurate aid of the Zero Reader type, which would give a suitable presentation to the pilot, was required. He emphasized, however, that whatever aids were developed, they should be suitable as regards both weight and cost for installation in even the smallest types of aircraft, as in extensive air operations the margin of safety was governed by the standards of the poorest rather than the best air-crews.

"VOICE OF INEXPERIENCE"

AN entertainingly outspoken paper by A.V-M. D. C. T. Bennett entitled "The Voice of Inexperience" was read for him in his absence by S/L. D. Bower.

London Control (said the speaker) is an example of the over-organization which has evolved since the end of the war —partly under the influence of expectations of high traffic densities, but more directly, I suspect, from a natural desire towards "Empire-building." When one notes the existence of Area Control, Approach Control and finally (handling one aircraft at a time!) Airfield Control, all falling over one another with the best intentions in the world, then one cannot avoid such an unkind phrase as "Empire-building." Further, in practically all aircraft there are at least two reasonably intelligent human beings, and they have some idea of what they are doing; if we rely on these people even half as much as we do the controllers in "the tower," then surely we could simplify procedure considerably. Moreover, if we were to allow those same controllers to use their discretion a little instead of being bound by rigid rules, then I feel confident that traffic would soon flow normally again.

I believe that the practical flying-control officers, particularly in Great Britain, deserve the greatest sympathy and support. As I see it, they are severely restricted by this wicked god called "Standardization." Under the excuse of standard international procedures, flying-control officers are seriously impaired in carrying out a perfectly normal duty of assisting aircraft by reason of the fact that information is not readily available to them. British flying-control officers suffer from poor and insufficient communications.

Let us remember, basically, that in daylight and in good visibility no mandatory flying control whatever is necessary, or desirable in any way, and let us also remember that this statement applies equally to the "600 m.p.h. aircraft" because, after all, even a Comet at low level has a very low air-speed. The problem, therefore, resolves itself into two parts: (a) to give information in order to expedite landings and take-offs in good conditions; and (b) to give information and instructions when blind or at night. The guiding principle should be to allow maximum freedom of command for the captain of the aircraft in all things in which he can best decide, but to give complete freedom to the control officer to give instructions where captains cannot decide.

One of the excuses for our deficiencies in flying control since the end of the war has been lack of standardization of international aids. That we should fail at Montreal to "sell" Gee was deplorable but might have been a blessing had we immediately expanded and developed the use of Rebecca and its appropriate ground beacons. That we should to this day be contemplating the extended use of M.F. beacons and M.F. ranges is, in my view, a catastrophe. They are not only unsatisfactory in that they give no assistance to accurate timing but merely to directional aid—they also prove thoroughly unreliable in heavy static and thus fail in their object in the very conditions when they are most required. The use of Rebecca on the Berlin Air Lift was a clear case in its favour. There, in spite of violent changes of wind and of slow reporting thereof, spacing and timing remained good throughout. The one outstanding feature of flying control on this operation was in the early stages when there were no senior officers and no organization. During this happy period the control officers at Gatow worked with the mutual confidence of the pilots concerned, even allowing two aircraft to sort themselves out when they were better able to do so than was the flying control officer concerned. The result was a higher landing rate, a far greater degree of safety and, incidentally, a far happier atmosphere than ever was subsequently achieved on the Airlift or, for that matter, in any other flying control system I have known.

It seems that, if really large numbers of aircraft are to be handled, we must as far as possible ensure the self-sufficiency of each, both with regard to (a) navigation aids and (b) landing aids, and then we must give each individual aircraft maximum freedom with the minimum necessity for communications with the ground within a traffic pattern which is more or less automatic. Such a pattern must obviously depend upon the circumstances, and London Area is, to my view, the most difficult in the world. It seems, however, that the four-quadrant system, whereby approaches into the zone are made from any one of four equally spaced points on its perimeter and exits are made through any one of four other points spaced approximately half-way between the entry points is a system worthy of attention. By all means let us spread in height and in distance, but lateral displacement is also justifiable when one comes to the really high density which we must hope for, in spite of ourselves, in the London area.

Then let us simplify communications by having one "area approach" channel and one "airfield" channel for each airport. To have Area Control, Approach Control and Airfield Control is thoroughly dangerous and unnecessarily expensive. When, moreover, Airfield Control is on a frequency which is so congested that it is impossible to get a word in edgeways then the whole thing becomes dangerous—for, after all, it is only "in the circuit" that collision risk goes up. Finally, whilst on the subject of communication, let us give guidance to our foreign friends by exemplary procedures, while still permitting those who can speak English to do so naturally and briefly.

To sum up, therefore, I would say that our requirements are: (a) Freedom of command for the captain where applicable, and (b) freedom of the air traffic officer to instruct where necessary (c) adequate telephonic communications, single-stage only for isolated airfields; two-stage for airfields in a high density area; (d) navigation aids in the following order of preference: (i) D.M.E. (Rebecca), (ii) Hyperbolic Fixing systems (Gee, Decca, etc.), (iii) V.F.H. multi-track ranges, (iv) V.H.F. D/F., (v) M.F. beacons adequate in number and in power, (vi) radio ranges, (vii) ground D.F. stations—to this list must be added superimposed primary ground-radar for surveillance where justified in high-density areas, (e) adequate landing aids in the following order of preference: (i) B.A.B.S., (ii) G.C.A., (iii) I.L.S., (iv) S.B.A.

We must, of course, remember that landing aids, even with the assistance of flying control, are valueless in this climate unless we have the one safety worthy of the name—i.e., Fido, which is, incidentally, not only a great safety device but also a great saving device.

TERMINAL NAVIGATION

IN a paper dealing with Terminal Navigation, Mr. D. Barnett (R.A.F. Transport Command) considered that the solution to the traffic-control problem was to be found in the development of tracking and control systems of such high precision that the aircraft would never be permitted to get off track or off schedule for the last 20 minutes of its flight—a principle of control which he termed "preventive navigation." The speaker reviewed such varied systems at present in use as the A.D.F. system at La Guardia (claimed to have a handling capacity of 15-20 aircraft per hour in I.F.R. condition), the Transport Command controlled-landing system (employing medium-range navigation aids to define a circular traffic pattern in which the space/time characteristics are calculated by means of simple computers) and the direct-entry system used in Operation Plainfare.

Mr. Barnett gave details of much of the practical work which had been carried out to determine the possible accuracy of timing control along a track and enumerated factors which required further study, among them being the effect of slip-streams on the final approach, allowance for overshoots, and variations in aircraft and wind speeds. He considered that the ultimate solution to the rapid-landing problem was likely to be through the development of a means of measuring precisely each aircraft's position, coupled with computational mechanism by which each aircraft could follow a known track and maintain a known time-schedule.

HERE and THERE

Car-ferry Expansion

DURING 1950, the Bristol Freighters of Silver City Airways are expected to carry 6,000 cars across the English Channel; the 1949 figure was 2,700. Under an associate agreement with B.E.A., Silver City Airways have received M.C.A. permission to operate the service for a further period of two years. The company plans to use extra aircraft, and there will be additional facilities for passengers and Customs at both terminals—Lympne and Le Touquet.

Stratocruiser Production

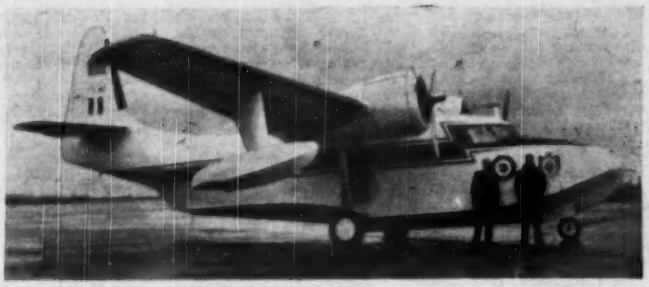
THE Boeing company will, it is reported, shortly deliver the 55th and last Stratocruiser to be built under existing contracts. However, production of the C-97A is continuing, and orders for this latest military version have been brought up to a total of 64, of which about 12 have been delivered. Aircraft bought under new contracts will, it is stated, be priced "considerably higher" than the original 55.

Variety at Brussels

DATES have now been fixed for the four types of flying display to be held during the Brussels International Aeronautical Exhibition. Throughout the Exhibition—from June 10th to 25th—helicopters will be flown daily before the Grands Palais du Centenaire. Light aircraft will be demonstrated on June 18th at Grimbergen airfield, while flying displays of military and heavy types will take place at Brussels National Airport (Melsbroeck) between June 20th-24th. The closing display, at Deurne (Antwerp) on June 25th, will be as comprehensive as possible, involving all types.

Strategic Strengthening

ACCORDING to latest reports from the United States each of the nine B-29 Superfortress-equipped groups of the U.S.A.F.'s Strategic Air Command now consists of 65, instead of 30 aircraft. The expansion has probably been made possible by placing in service "cocooned" reserve bombers of this type. At the same time it is learned that delivery of Convair B-36 bombers has been speeded up; 216 are on order.



REGAL: The Grumman Mallard which, as described on this page, has been delivered to the King's Flight of the Royal Egyptian Air Force. Standing alongside are (right) Capt. J. W. Hackett and Mr. M. V. Cole, who ferried it from America to England.

Reunion Film Show

ARNHEM LIFT, Rhine Crossing and other films recalling wartime airborne operations will be seen by many ex-members of the participating forces when the 38 Group Old Comrades' Association holds its reunion on March 11th. It is hoped that the Association's president, Air Marshal Sir Leslie N. Hollinghurst, will preside at the dinner which precedes the film show.

The reunion is being held at the Paviour's Arms, Page Street, Westminster; tickets (15s) are obtainable from Mr. W. Scrivens (hon. secretary, Old Comrades' Association, R.A.F. Stations Hurn, Harwell and Rivenhall—38 Group), 54, Lombard Street, London, E.C.3.

Not the Time

IN a statement deploring the recent Government cuts in expenditure on military transport aircraft, the Air League of the British Empire says that the decision must mean either that the Services are to be left without adequate air transport which would be a vital need in time of war, or that it is proposed to rely on foreign sources either for the supply of transport aircraft for the R.A.F. or possibly for the provision of complete air-transport squadrons.

"This is not the time to weaken an industry which plays so important a part, not only in our national defence, but also in our economic recovery," adds the statement. "Our aircraft industry leads the world in very many aspects of aviation development. We should be using it . . . to increase our exports as well as to strengthen our defences."

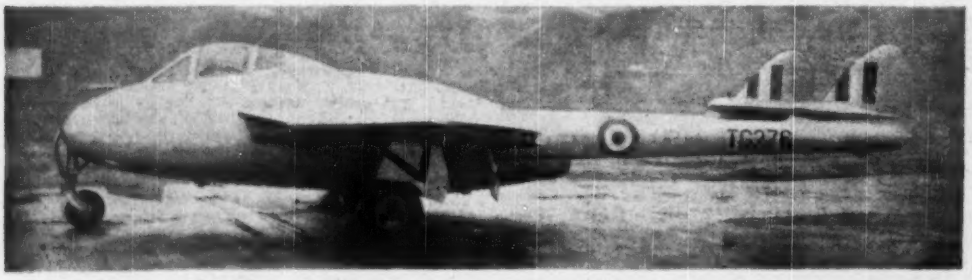
Very similar sentiments were expressed in our leading article of February 16th.

Fit for a King

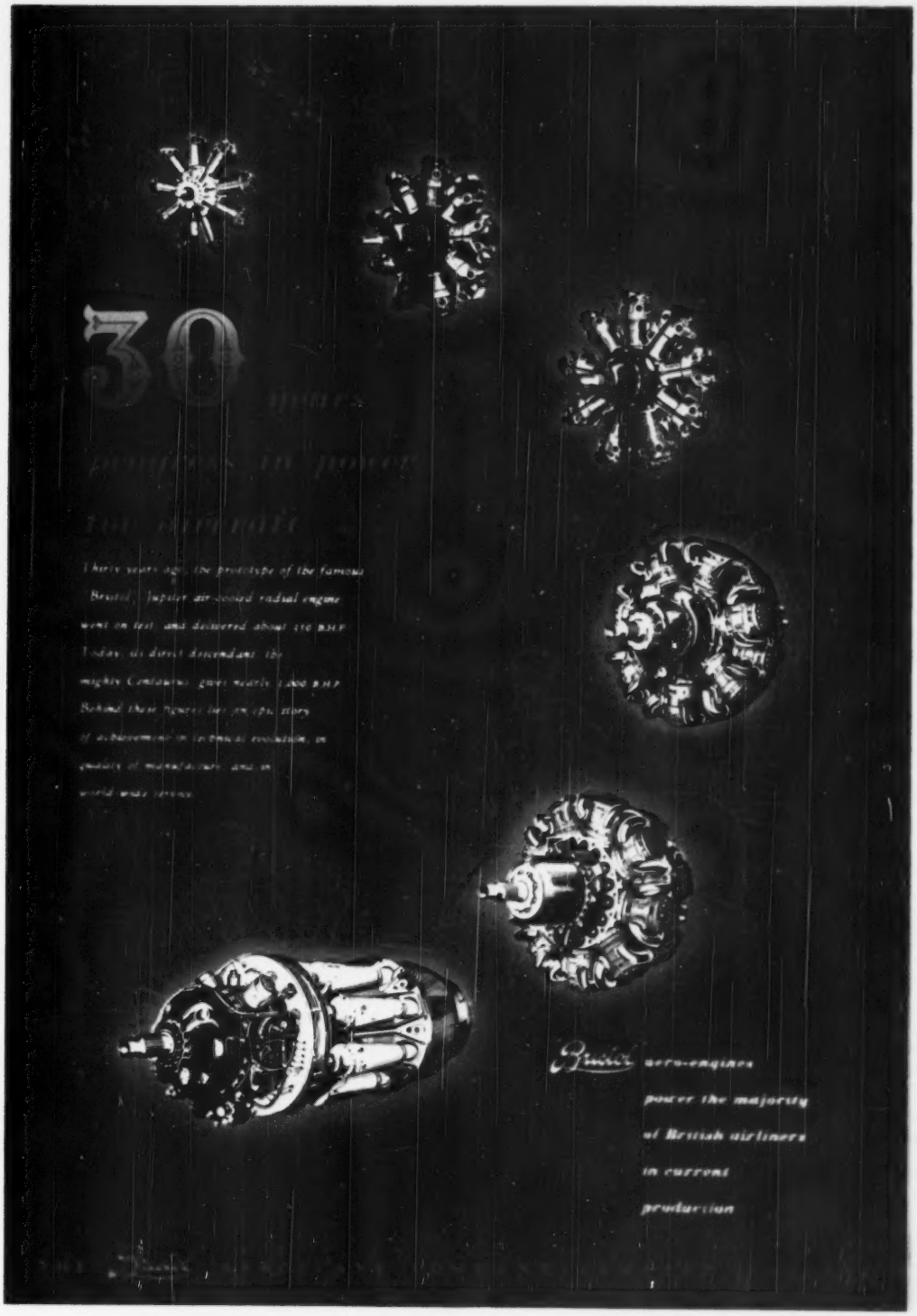
DESCRIBED by an expert as "literally in a class by itself as far as fittings, furnishings and exterior finish are concerned," the Grumman Mallard (two 600 h.p. P. and W. Wasps) illustrated on this page has recently been delivered to the King's Flight of the Royal Egyptian Air Force. It was ferried from New York by Britavia, Ltd., of London. Capt. J. W. Hackett (with Mr. M. V. Cole as navigator/radio operator) following the North Atlantic route *via* Goose Bay, Bluie West One and Iceland. G/C. Akef, Captain of the Royal Flight, took the aircraft into Egypt.

Rockets Plus

DURING a three-week visit to Australia, which began last week, A. Cdre. John D. Baker-Carr, Director of Armament Research and Development at the Ministry of Supply, is making a first-hand study of progress at the Woomera rocket range in Central Australia. Shortly after his arrival in Darwin on February 21st, A. Cdre. Baker-Carr



DEEP-BREATHING EXERCISE: First picture of the latest version of Nene-Vampire as developed by Boulton Paul Aircraft, Ltd. Standard Vampire air-intakes, designed for the Goblin, proved inadequate for the more powerful Nene. Additional "horn" intakes were tried but the scheme depicted, with the ducts from the enlarged intakes passing through the spar, as on the Hawker Jet fighters, represents a new and altogether more satisfactory approach to the problem of aspiration.


30
years
progress in power
The Jupiter
Thirty years ago the prototype of the famous Bristol Jupiter air-cooled radial engine went on test and delivered about 550 B.H.P.
Today its direct descendant the mighty Centaurus gives nearly 2,800 B.H.P.
Behind these figures lies the story of achievement in technical evolution, in quality of manufacture and in world wide service.
Bristol aero-engines power the majority of British airliners in current production

Night Refuelling at Shannon

ESSO SERVES AVIATION

Nine out of twelve Airliners using Shannon Airport are fuelled by . . . .

AVIATION ESSO SERVICE

ANGLO-AMERICAN OIL COMPANY LIMITED

HERE AND THERE . . .

stated that Australia is playing a "bigger and better part" in the general research and development of armaments; there were "more things going on" than the activities at Woomera.

Belgium's Air Arm

REVIEWING for the Belgian Senate the country's military resources under the Brussels and North Atlantic Treaties, M. Deveze (Minister of Defence) described the air force as "an efficient weapon." At present on order from Britain were 50 Meteors, 20 Spitfires and 12 Mosquitoes.

R.A.F.A. Remembrance

DURING 1949 R.A.F. Association branches throughout Britain gave £15,047 to the R.A.F. Benevolent Fund. Of that sum, £8,860 was raised by branch activities during Battle of Britain Week. A recent performance of *Three Men on a Horse* by the Stock Exchange Dramatic and Operatic Society brought £729 for the Fund.

Mighty Atom

MUCH of the success of the intriguing Fouga Cyclone powered-glider, demonstrated so effectively at the recent Miami meeting, is due to its Piméné power unit. The Turbomeca company, makers of this miniature turbojet, have announced an increase in the power output of the Piméné, now rated at 242 lb thrust instead of the former figure of 220 lb.

The new rating was established on February 18th, after successful completion of two consecutive and uninterrupted runs of 150hr under I.C.A.O. conditions. No attention was required during either period. Development of the Turbomeca series of small turbojets was outlined in *Flight* of January 12th.

Met. Meeting

AS part of the celebrations marking the centenary of the Royal Meteorological Society, a symposium is being held at Oxford from Tuesday to Friday, March 28th-31st. Leading meteorologists from the United States and several European nations will be among the speakers and subjects of discussion will include Physics of Cloud and Precipitation, Structure of Weather Systems, the General Circulation, and Climatic Change. Those to whom meteorology is an important study may be able to obtain tickets if they make early application to the assistant secretary of the Society at 49, Cromwell Road, London, S.W.7.

NEXT IN THE QUEUE: First of the Reserve units to receive their D.H. Chipmunks are the Oxford and Cambridge Squadrons. Oxford received theirs on February 3rd and on February 17th it was the turn of the C.U.A.S. Above, at Cambridge, are seen (left to right) Mr. R. H. Melville (Permanent Assistant Under-Secretary of State for Air), F/L. Bailey (ferry pilot), S/L. Godfrey (C.F.I.) and W/C. C. H. Simpson (C.O.).

NEWS IN BRIEF

DATES of the National Gliding Contests have been put forward a week. Details will be found in "From the Clubs" (p. 283).

* * *

S/L. Basil Arkell, whose demonstrations of the Cierva Skeeter will be remembered by S.B.A.C. Show visitors, is on his way to South Africa, where he is to investigate the possibilities of British helicopter sales.

* * *

A British Plastics Exhibition—the first trade show to represent the whole industry—is to be held at Olympia in June next year. The organizers will be *British Plastics*, one of the journals published by Associated Iliffe Press.

* * *

J. Maclean, a junior draughtsman of Short Bros. and Harland, Ltd., has gained the distinction of being the first Northern Ireland candidate to win the Hele-Shaw Memorial Prize and Bronze Medal of the Institution of Mechanical Engineers.

* * *

Mr. Jess W. Sweetser has been appointed assistant to the president of the Glenn L. Martin Co., and will be in charge of sales and contract administration. He was with Curtiss-Wright during the war, and was subsequently appointed advertisement director of *Esquire* magazine.

Mr. E. J. Waddington, A.C.A., and Mr. R. P. H. Yapp have been appointed directors of Vickers-Armstrongs, Ltd., with effect from March 1st. Mr. Waddington will retain the office of secretary.

* * *

Wolf Electric Tools, Ltd., announce the opening of a Canadian branch at 2271, Bloor Street West, Toronto, 9. Stocks of Wolf tools, accessories and spare parts are supported by a coast to coast after-sales-service. Mr. John Best is in charge.

* * *

Positive Prevention of Corrosion by A.C. Compounds is the title of a brochure recently issued by Manchester Oil Refinery (Sales), Ltd., 2, Mosley Street, Manchester, 2. These compounds are prepared in five different grades for specific purposes.

* * *

At the general meeting of de Havilland Aircraft of Canada, Ltd., Mr. P. C. Garratt (vice-president) said the company's manufacturing activities had now reached a point at which the repair and maintenance side, though still important, accounted for only about a third of the business. Messrs. W. E. Nixon and R. E. Bishop, both of the English company, were elected to the board.

POWERFUL NUCLEUS: Since 1937 thirty-eight Halifaxes and 150 Hercules engines have been reconditioned for various civil or military duties by Airtech, Ltd. Here are seen six Mark 6 Halifaxes now fully operational, which were despatched recently from Thame Airport to become the nucleus from which the Royal Pakistan Air Force will form its bomber squadrons. Airtech's associates, British American Air Services, are ferrying the aircraft east.

HERMES HEREWITH: As reported on this page, B.O.A.C. has taken delivery of its first Hermes IV; the aircraft was handed over at Radlett airfield on February 22nd. The line-up suggests that the manufacturers are anxious to deliver more Hermes at once.

CIVIL AVIATION NEWS

B.O.A.C.'s FIRST HERMES

THE first aircraft of B.O.A.C.'s order for 25 Hermes Mk. IVs was delivered to the Corporation at the makers' airfield at Radlett on February 22nd, and the same afternoon it was flown to the B.O.A.C. base at Hurn. As stated in the article, "Hermes IV in the Air" on page 285, the first batch of aircraft will be taken over for crew training, familiarization and operational development flights; they will then be introduced on the African routes, where they will replace the Solents at present flying on the South and East African services and the existing York flights to West Africa.

As reported in *Flight* of February 9th, all tests for the normal C. of A. (temperate conditions) have now been completed. One aircraft is at present undergoing engine-cooling tests in tropical conditions at Khartoum, which it is hoped will be completed within the next two weeks. When the full Certificate of Airworthiness, covering operations in both temperate and tropical conditions, has been issued, the remaining aircraft will be handed over at regular intervals as they are completed.

BELGIAN ORDER FOR COMETS?

SABENA'S South African manager, M. Bourgois, is reported to have stated that his company has placed a provisional order for six D.H. Comets for use on African routes. No confirmation is forthcoming as we go to press; neither, however, is the report denied. It is known that there have been some discussions between Sabena and de Havilland. Sabena operates several long-distance routes (mostly with DC-4s and DC-6s), including one from Brussels to the Belgian Congo *via* Cairo, and another from Amsterdam to South America. The report indicates that Comets might be used on the 6,000-mile Brussels-Johannesburg route, possibly making stops at Elizabethville and Libenge in the Belgian Congo.

I.A.T.A. ACTIVITIES

THIS year's I.A.T.A. annual general meeting is to be held at San Francisco, from October 16th to 20th. It will be the first time the general assembly has met in the United States. Succeeding Dr. Albert Plesman as president of I.A.T.A. will be Mr. Warren Lee Pierson, chairman of the board of T.W.A., who was elected at the association's last general meeting at The Hague in September, 1949.

The major U.S. airlines will act jointly as hosts to the visiting heads of the international member-companies. The meeting will deal with such matters as the determination of general airline policy and the establishment of budgets and will also approve the selection of personnel for the airlines' joint activities in financial, legal, technical, traffic and other fields. Other I.A.T.A. groups, including the executive committee, will hold preparatory meetings shortly before the general assembly. The Traffic Conference, which will make recommendations on international fare structure and conditions of carriage, will hold its main session in May, while the Technical Conference, to be held in the same month, will review the technical policies of the world's international airlines and their relations with such bodies as I.C.A.O.

Meanwhile, in London, I.A.T.A. has announced that interline transactions by the 36 airline members of the London Clearing House totalled some $167,000,000 during 1949 as compared with $124,000,000 in 1948 and only $52,000,000 in 1947 (which, it will be recalled, was the first year of the arrangement for international traffic clearing). In a recent statement, Sir William P. Hildred, director-general of I.A.T.A., said: "The sustained increase in I.A.T.A. Clearing House transactions reflects the growing extent and importance of scheduled international air-traffic throughout the world." Sir William considers that the 1949 figures were particularly impressive in view of the period of financial uncertainty which resulted from devaluation.

ITALIAN CHARTER RESTRICTIONS

THE attitude of the Italian authorities in refusing to grant clearances for charter freight-carrying aircraft using Milan is causing some concern among British operators. For some time such aircraft have been taking bulk-loads of penicillin into Milan and returning with textiles, a combination whereby favourable reductions in freight rates have been made possible to shippers. In recent months the only aircraft which could offer the required rates and provide the required capacities were Halifaxes, chartered on the open market through the medium of the Baltic Exchange.

It was a few weeks ago that the operators began to experience difficulties in obtaining clearances from Italy. The Italian authorities required that four days' notice of a flight should be given, and followed this by a stipulation that aircraft should not arrive in Italy directly from London, but should make one stop *en route*. Two flights were made under these circumstances in spite of the diversional flying and extra landing fees necessitated by a stop at Zurich. On a third occasion a Halifax had actually fixed a load of textiles from Milan, but on arrival the aircraft was refused permission to load its cargo.

Although outward and return cargoes have since become available, all clearances for such flights have now been refused without any reason being given. B.E.A., who sometimes perform charter flights to and from Italy, are said to have experienced the same difficulties in obtaining clearances and permission to emplane cargoes on a charter basis.

The refusal is considered by the British companies to be a violation of the International Air Transport Agreement. It is understood that the M.C.A. is attempting to investigate the Italian objections through the British Embassy in Rome.

T.W.A. ATTACKS MERGER

TRANS-WORLD AIRLINES have reiterated their request to the C.A.B. to veto the proposed purchase of A.O.A. by P.A.A. According to a statement issued by T.W.A., the result of such a merger would be that the company would be forced out of international operations. Of the passenger total carried by the three companies on transatlantic services in

1949, Pan American accounted for 37.7 per cent, A.O.A. for 25.5, and T.W.A. for 32.8. The proposed merger would thus permit P.A.A. to participate in 67.2 per cent of the total traffic regardless of any further adjustment due to its increased size. T.W.A. calls upon the C.A.B. to uphold the U.S. Government's present policy of regulated competition in American international air traffic.

The protest is couched in strong terms; part of it states: "The Government must decide whether it is to remain steadfast in its opposition to monopoly in this field, or succumb to the unrelenting pressure of the most powerful and sinister form of influence that has ever represented American industry in its relations with the Government."

Both Pan American and A.O.A. are said to have failed to establish any valid reasons why the present three-company system should be abandoned in favour of what would virtually constitute a P.A.A. monopoly.

COMET PRESSURIZATION TEST

THE de Havilland Comet made its longest non-stop flight to date on February 21st, when it took off from Hatfield and remained in the air for five and three-quarter hours. The aircraft flew for the first time with the cabin differential pressure increased to 5½ lb/sq in; during earlier flights it was pressurized at a differential of only 2 lb/sq in.

The Comet is reported to have climbed to 41,500ft (a little over its most economical cruising altitude) and fuel-consumption checks were carried out at a variety of speeds and heights. On board, in addition to the normal crew of five, was an observer whose duties were mainly concerned with the pressurization equipment.

SKYJEEP PROGRESS

THE manufacturers' report on progress with the Chrislea Skyjeep indicates that a C. of A. may be forthcoming some time during March. The type C.H. 3 series IV, as the Skyjeep is officially designated, made its first flight in November and it has been undergoing continuous development trials since that date.

The Skyjeep can accommodate four passengers with provision for two additional occasional seats for children; the payload is 510 lb at standard range (520 miles) or 610 lb at 345 miles range. At maximum a.u.w. (2,500 lb) an economical cruising speed of 115 m.p.h. is claimed. The price of the aircraft is quoted as a little over £2,000. The Skyjeep is powered by a 155 h.p. Cirrus Major III, and its undercarriage is adaptable for Goodyear cross-wind landing gear. Standard fuel capacity is 38 gal, but an additional 20 gal may be carried in long-range tanks.

CHARTER PROTEST

SEVERE criticism of the terms of the Civil Aviation Act, 1946, which afforded the State-owned corporations a virtual monopoly of British scheduled air services, is contained in a booklet issued last week by the British Air Charter Association and presenting "the case for the independent air-transport companies in the United Kingdom." The 1946 Act and subsequent legislation is, says the B.A.C.A., "cramping civil aviation and the business and trade which flow from rapid communications." Additionally, the policy has, it is argued, been creating unemployment in the air transport industry, restricting the market for new aircraft and postponing the day when airfields will be self-supporting.

Particular reference is made to the shortcomings of Section 24 of the Air Corporations Act, 1949 (formerly Section 23 of the 1946 legislation), which imposes severe restrictions on the operational activities of the charter companies. The fact that the operation of routes under associate agreements is by no means a permanent policy is already becoming evident. The legal powers vested in the State by the terms of Section 25 of the Act, says the booklet, give the Minister of Civil Aviation "powers of inquiry which can be inquisitorial" and are contrary to the principles of English justice.

Under Section 15, the smallest independent company is required by law to give the same rates of pay and conditions of employment as one of the subsidised corporations against which it is not allowed to compete. The Association states "the strict application of this section to every charter company in the country will almost certainly mean that many of them will have to go out of business . . . ."

The proposal is made that a new Civil Aviation Act should be instituted whereby the M.C.A. would merely be permitted to administer and not to legislate. A revised system of air-transport licensing, to be controlled by an independent authority, is also advocated. Furthermore, the Association considers that air transport should be dealt with as a commercial activity and completely divorced from politics. It is suggested that the position of subsidized and non-subsidized companies should be regulated on the principle that a subsidy would be paid by the State only for services which cannot be provided by private enterprise without the assistance of such a subsidy, and only if these services are needed by, and would benefit, the community.

There should be no need to point out again the potential value of the charter companies' facilities in the event of war; but this aspect alone, to say nothing of the valuable part which the charter operators could play in assisting our trade and commerce, should be sufficient to justify a change of policy in favour of the independent operators.

A NEW BELLANCA

A NEW American private four-seater which appears likely to achieve considerable popularity is the Bellanca 190 Cruisemaster. This Lycoming-powered version of the original Cruisair is reported to have a maximum climb of 1,600 ft/min and a cruising speed of over 170 m.p.h. Versions will be available with both the Hartzell selective fully controllable-pitch airscrew and the normal Aeromatic type. Standard fuel capacity is 40 gallons in the wing tanks, giving an endurance of 3½ hours and a range of 630 miles; overload tanks give a range of 1,000 miles.

Overall length is approximately 23ft and the span 34ft 2in; the fully cantilever wing is of plastic-laminated plywood with a ¼in skin. A novel feature for a small aircraft is the design of the radio aerial, which consists of aluminium foil glued to the inner surface of the wing, access being obtained through inspection holes in the under surface. Price is in the region of $9,500. A photograph appears overleaf.

B.O.A.C. "TRADE FLIGHT"

PRECEDING the introduction of the Argonauts on the South American route on February 28th, B.O.A.C. despatched an aircraft of this type on what is termed a "trade flight" to cover the projected route. Passengers on the flight include Mr.

ROLLING UP TO RIO: Among those boarding the B.O.A.C. Argonaut for the South American proving flight referred to on this page are (second from left) Mr. J. W. Booth, (bottom left) Sir Victor Tait, and (fourth from left) Mr. Keith Granville.

CIVIL AVIATION NEWS . . .

J. W. Booth, deputy chairman of B.O.A.C.; Sir Victor Tait, the Corporation's director of operations; and Mr. Keith Granville, general manager, sales and traffic.

Before leaving, Mr. Booth stated that they hoped to meet Government officials, leading citizens, representatives of aviation and travel organizations and as many members of the general public as possible in all countries on the route. The purpose of the trip, he said, was to learn at first hand the traffic requirements and prospects of increased passenger and cargo business, in view of the fact that B.O.A.C. was now operating more competitive aircraft on the South American services.

Demonstration flights are being given at certain points, and the flight will end at Santiago on March 6th. On the return flight to the United Kingdom, the aircraft, which is commanded by Capt. G. H. Womersley, D.S.O., D.F.C., will operate a normal scheduled service.

A 40-seater version of the Argonaut will be used on the scheduled route, which will be flown *via* Lisbon, Dakar, Natal, Rio de Janeiro, Sao Paulo, Montevideo, Buenos Aires, and across the Andes to Santiago. Depending on the stage-length and number of passengers, up to 1,500 kg of mail and freight can be carried, although this figure may be increased in special circumstances by minor modifications to the seating arrangements. Elapsed time for the flight from London to Santiago is approximately 56 hours.

BREVITIES

IT is reported that Leith (Edinburgh) Dock Commissioners have authorized an application to the Minister of Civil Aviation, requesting approval for a licensed flying-boat landing area at Leith.

* * *

Activity at Kastrup Airport (Copenhagen) in 1949 showed a considerable increase in passenger traffic, although the number of scheduled aircraft movements decreased from 32,400 (in 1948) to 28,012 as a result of the greater seating capacity afforded by each aircraft. Two-thirds of the traffic is accounted for by aircraft of S.A.S. Incidentally, this organization flew 408 charter flights last year.

* * *

The M.C.A. announces that, with effect from March 1st, the position and bearing service in the Northern, South-eastern and South-western Flight Information Regions will be provided by two M.F. D/F. networks only. The stations at Ronaldsway (Isle of Man), Newcastle, Exeter and Southampton will then cease to operate.

* * *

Sir Miles Thomas, chairman of B.O.A.C., who is at present visiting Australia, stated recently in Sydney that a direct air service using Solent flying-boats would be operated between Sydney and Wellington (New Zealand) within a matter of weeks. The present link between the two countries is restricted to a flying-boat service between Sydney and Auckland. Additionally, Sir Miles stated that a further route linking Melbourne and Christchurch is being planned.

* * *

T.W.A. announces the purchase of an additional six Constellation 649s, bringing to 61 the total number of this type which the company has in service or on order. Another interesting order is that by Capital Airlines for five Constellation 049s, to be paid for on a 36-month interest-free instalment plan. It is believed that this is the first time an airline has arranged such a "hire-purchase" plan with a manufacturer. The payments will amount to $105,000 a month.

* * *

P.A.A. is now experimenting with the carriage of fresh oysters from Australia to Honolulu; a similar service to Singapore has been flown by Qantas Airways in recent years. If the experimental consignment is successful, it is expected that many thousands will be taken on each P.A.A. flight, thus providing a considerable dollar-earning potential for Australia. Although oysters will normally remain in good condition for three days, the main problem is that of temperature changes.

An agreement signed in Damascus between Holland and Syria will enable K.L.M. to operate three routes *via* Syria to the Middle East, Pakistan and further points east. Permission is also given for a Syrian company to inaugurate routes to or *via* Holland, but no definite plan for such operations has as yet been evolved.

* * *

An analysis of British civil aircraft registered as at February 13th, 1950, shows a total of 1,939. Of this number, 253 are accounted for by the two Corporations, B.O.A.C. and B.E.A.C.; 330 belong to civil clubs and training schools; and 256 are privately owned. Some 629 aircraft are registered for taxi, charter and aerial work purposes.

* * *

A bilateral agreement between Canada and Norway has been signed in Ottawa to provide for direct air traffic between the two countries. It is similar in form to agreements already signed by Canada with Sweden and Denmark. Gander is named as the Canadian airport at which Norway may exercise traffic rights.

* * *

S.A.S. and A.O.A. are understood to have issued a protest to the Council of Stockholm against an order from the Swedish health authorities forbidding aircraft to taxi at Bromma Airport between 2 a.m. and 5 a.m. It is said that the morning sleep of nearby inhabitants was being disturbed. The companies claim that the order is causing the curtailment of important traffic.

* * *

For the period of the British Industries Fair, which will be held at London and Birmingham from May 8th to 19th, a daily air-taxi service will be operated by Air Enterprises, Ltd., of Croydon, to link the two cities. London departures will be from Croydon and Hendon; at Birmingham aircraft will use Castle Bromwich airfield, where the machines can taxi to a point within 75 yards of the main entrance to the Fair. Return fare will be £4 18s.

* * *

An agreement has been reached between K.L.M. and the Indonesian Republic on the formation of an airline to operate domestic and international services in that country. The new company is to be known as Garuda Indonesian Airways and will receive a 30-year concession from the Indonesian Government, which, together with K.L.M., is participating in the venture. K.L.M. is to manage Garuda for the first two years and provide personnel until Indonesians have been trained.

* * *

P.A.W.A. announces the appointment of Col. C. M. Young to be a vice-president of the company from March 1st. Col. Young, who has been prominent in aviation circles from 1926, is at present head of the Department of Airports at Los Angeles.

* * *

As a result of plans made at the three-day I.A.T.A. conference which has just ended in Paris, an increase of approximately 20 per cent in available seating capacity is to be provided by European airlines this summer. Many all-cargo

U.S. NEWCOMER: This view of the Bellanca Cruisemaster, described on page 281, gives the impression that the aircraft has an extremely roomy cabin.

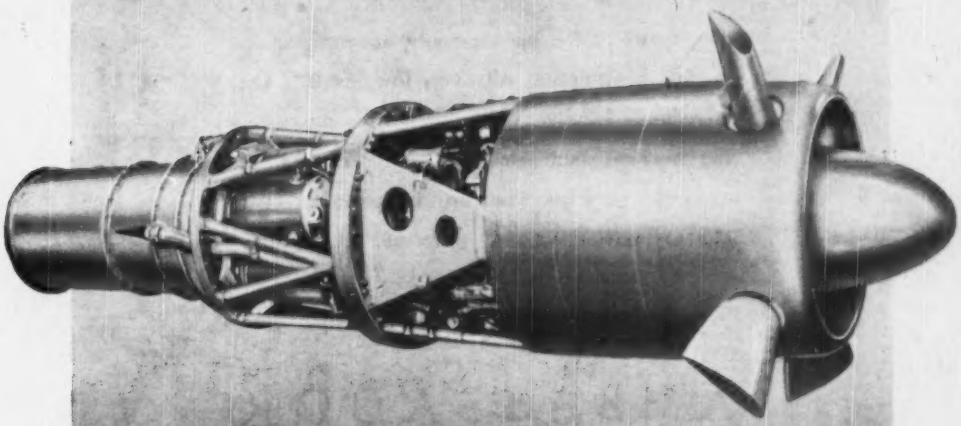
NAPIER NAIAD

PROPELLER TURBINE ENGINE

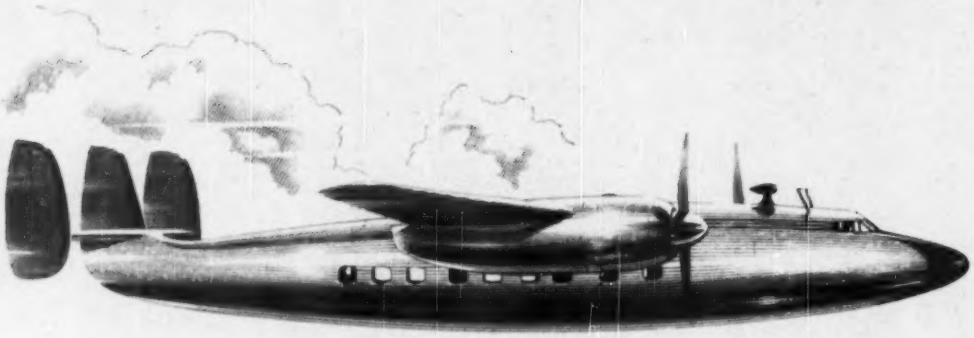
TOTAL E.B.H.P. — 5580

WEIGHT — 1095 LBS.

DIAMETER — 28 INCHES



D. NAPIER & SON LIMITED LONDON W.3



The latest measurements have again confirmed the results of previous tests which showed the cruising speeds of the Ambassador, at different heights and powers, to be better than estimate.

The figures have been equally encouraging in normal operation at relatively low levels. On a recent demonstration flight, for instance, the average true air speed worked out at 253 miles per hour when cruising at 60 per cent METO power in M gear at 8,000 feet.

AMBASSADOR

AIRSPEED LIMITED · CHRISTCHURCH AND PORTSMOUTH · ENGLAND

In association with the de Havilland Enterprise

CIVIL AVIATION NEWS . . .

services (both day and night) will be included in the new schedules. The chairman of the conference, Mr. Max Stuart-Shaw, of Aer Lingus, stated that the volume of air cargo carried by European operators had more than doubled in the past year. Tourists to the Holy Year celebrations in Rome are expected to account for a considerable proportion of the increased seating capacities.

* * *

The Joff Airport at Dakar, originally constructed by U.S. forces during the war, is to undergo considerable reconstruction in the near future. It will include extension of the existing N.-S. runway and the construction of a third runway capable of handling aircraft of over 130 tons a.u.w.; an hotel will also be built. In 1949, Air France operated 22 of a total of 30 services based on Dakar.

M.C.A. Circular No. 21/1950 calls attention to the fact that pilots have been in the habit of performing spins in aircraft possessing only Normal Category C.s of A. Pilots are reminded that intentional spinning is an aerobatic manœuvre and may be carried out only in aircraft certified in the aerobatic category. It is emphasized that this regulation applies to all types of machines, including those used for training purposes.

* * *

Passengers at London Airport will shortly be guided through the customs and immigration halls and the final departure lounge by a network of red and green lights. This experimental plan, which has been evolved in consultation with the 17 companies regularly using the airport, will render it much easier for passengers to find their way along the correct route and will make possible an increase in passenger-handling rates without risk of confusion.

FROM the CLUBS

SPECIFICATION requirements for ultra-light-aircraft engines appear in a revised list in the January bulletin of the Ultra Light Aircraft Association. Desirable features, in their order of importance, are categorized as follows: (a) reliability, (b) cheapness, (c) simplicity and ease of maintenance, (d) ease of starting, and (e) smoothness and quietness in running. Performance, weight and the frontal area are regarded as secondary considerations. The U.L.A.A. feels that priority of development should be given to a 50 h.p. horizontally opposed air-cooled engine or to an inverted, air-cooled four-in-line. Second in priority is a 35 h.p. twin or four of the same configuration. The 50 h.p. engine is required for two-seat and high-performance single-seat aircraft, and the 35 h.p. unit for light single-seaters and motor gliders. For the upper limit of dry weight the comparatively high figure of 3½ lb/b.h.p. is intentionally recommended in order to permit the possibility of using standard car or motor-cycle engine components.

Engine designs at present in course of development include the conversion of a 1½-litre Neptune flat four-cylinder unit, which is expected to achieve 50 h.p. at 3,250 r.p.m. The successful 52 h.p. Zündapp which, in the opinion of the U.L.A.A., is the ideal power unit for such aircraft, is now the subject of negotiations with its German manufacturers with a view to possible development and production in this country.

In a review of current ultra-light-aircraft designs are listed the Slingsby Motor Tutor (which can be supplied in kit form for home construction at approximately £285), the Chilton monoplane, of which an improved version is being designed, at Redhill, by the College of Aeronautical Engineering; the Dart Kitten, for which a C. of A. has now been obtained; and the Fairey Junior, likely to be put into production when a suitable 50 h.p. engine becomes available. In addition, Hants and Sussex Aviation, Ltd., at Portsmouth Airport, reports that the Herald (described in *Flight* of November 17th, 1949) is now almost ready for its flight trials.

Reports from the Cardiff, Doncaster and Wycombe U.L.A.A. groups indicate that flying activity was restricted by bad weather during December and the beginning of January. The Community Flying Club, Flintshire Aviation Group, the Montgomeryshire Ultra-Light Flying Club, and South Hants Air Club all hope to start flying in the near future.

MID-EUROPEAN: The Hungarian-built Kanya 18, designed for glider-towing and general sports purposes, is now flying. This prototype has a 130 h.p. Walter Major IV engine, but production versions will have the 160 h.p. Walter Minor 6-III. A brief description of the aircraft—which bears some resemblance to the Fieseler Storch, and has the same good slow-flying characteristics—appeared in *Flight* of October 27th.

THE British Gliding Association announces that the dates of the National Contests, to be organized by the Derbyshire and Lancashire Gliding Club, have been changed. The events will now be held from the 22nd to the 30th July, with the 22nd as a practice day only.

It is also announced that standards for candidates seeking inclusion in the British team for any international contests will be (a) possession of a gold "C" certificate, and (b) a good record for previous competition flying, assessment for the latter qualification being made on results previously obtained by pilots in National and B.A.F.O. contests.

On the recommendation of the flying committee, the council of the Association has decided on the winners of a number of awards for 1949 performances. The de Havilland Cup goes to Capt. R. Garnett for attaining 12,240ft on a flight from Redhill in an Olympia in July, while the Manio Cup is awarded to Mr. D. H. G. Ince for a goal flight of 192 miles from Long Mynd to Yarmouth in an Olympia during August. The Wakefield Trophy is gained by Mr. P. A. Wills, C.B.E., for a distance flight of 232 miles from Hatfield to Gerrans, Cornwall, in a Weihe on May 1st. The Volk Cup and the Seager Cup were both awarded to Mr. J. W. S. Pringle, M.B.E., and Mr. J. Brantham for their 77-mile out-and-return flight from Dunstable to Cambridge in a two-seater Kranich on August 12th.

* * *

NOTWITHSTANDING the local spells of wintry weather in January, members of the West Riding Aviation Centre carried out a number of cross-country flights. The enthusiasts reported that with the aid of its cabin heater the club's Auster was quite comfortable even in the severest weather. The centre now has a resident Royal Aero Club observer so that all tests for a Private Pilot's Licence can now be completed at Yeadon, thus avoiding the necessity of travelling to London for examination by M.C.A. officials.

Approval has been obtained for operation of the Leeds-Isle of Man summer service, on which flights will be made daily, with four on Saturdays. This will be the third year during which this popular service has been operated from Yeadon. The Centre also reports considerable demand for charter "air lifts" to some of the principal sporting events throughout the country. Such flights have necessarily been curtailed during the winter by the closure of the airfield at 4.30 p.m., but it is hoped that the lighter evenings will again permit an extensive programme of charter flying to be carried out.

* * *

MANY enthusiasts who learned to fly at the Cotswold Aero Club in pre-war days will be interested to hear that it intends to resume full-scale activities when Staverton airfield is de-requisitioned in the near future. Negotiations are in progress with the object of resuming occupation of the club-house, the lease of which was suspended at the outbreak of war. The club secretary and flying instructor, Mr. J. Bennett (48, Shakespeare Road, Cheltenham), will be glad to hear from old members or from any prospective new members who may be interested.

* * *

ANSWERING many of the general queries which might be posed by the intending owner of a light aircraft, Auster Aircraft, Ltd., has compiled an informative booklet entitled "Auster Ownership." Such varied questions as those pertaining to the cost of operation, formalities when flying abroad and licences required, are fully answered.

B.E.A. HELICOPTER PASSENGER SERVICE

Twice-daily Cardiff-Liverpool Flights to Start in June

By day . . . : Using the Sikorsky S.51, B.E.A. inaugurated its first experimental mail service in February, 1948, carrying dummy mail bags on a nine stage circuit from Yeovil.

WHAT may be the world's first scheduled passenger service by helicopter is to be inaugurated by British European Airways on June 1st, on a route between Cardiff and Liverpool. Unless American operators (who are seeking C.A.B. authorization, already granted in one case) complete their projects in the meantime, the honour will definitely go to Britain.

The B.E.A. venture stands on a firm basis of preparatory experiment. Just over a year ago, in a paper before the Royal Aeronautical Society, Mr. N. E. Rowe, the Controller of Research and Special Planning in B.E.A.C., expressed the view that the helicopter could offer effective competition to existing means of transport on ranges of up to 250 miles. Prerequisites for such short-range operation were, he said, regularity and punctuality; an immunity from bad weather equal to that of any other form of surface transport; the ability to operate readily by day or night; and the provision of sufficient landing areas, or "rotorstations," suitably equipped for economical operation.

B.E.A. preparations, however, go further back than the date of Mr. Rowe's lecture. With the object of investigating these and other requirements, the B.E.A. Helicopter Unit (commanded by W/C. R.A.C. Brie) had been conducting a series of mail services, both dummy and "live," by day and by night, for over a year previously. The unit, consisting of three Sikorsky S.51 and two Bell 47D aircraft, was formed in October, 1947. The Sikorskys have since been employed on almost all mail services, the first of which—in the nature of a demonstration for the G.P.O.—began in February, 1948, and lasted five weeks. Based at Yeovil, this service was operated on a nine-stage West Country circuit, and carried dummy mail. Despite bad weather an excellent regularity factor of 96 per cent was achieved.

The first regular mail service was opened between Peterborough (base of the unit) and Yarmouth on June 1st, 1948, and was continued until September 25th. This daylight service also showed good results. Night-flying, with dummy mail, began on September 23rd, and was continued for five weeks. During the successive winter months a great deal of development on blind- and night-flying equipment work was continued, and problems of maintenance also received close attention. A second dummy night-mail service, between Peterborough and Norwich, was maintained with 93 per cent regularity from February 21st until March 21st last year. (The unit's excellent progress with instrument-flying was reported in *Flight* of March 10th, 1949.)

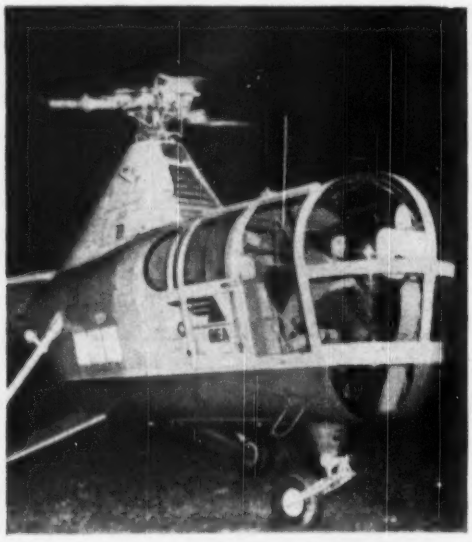
The world's first scheduled night-mail service, over the Peterborough-Norwich route began on October 17th last, following a contract between B.E.A. and the G.P.O. It is still in progress and is not due to end until mid April.

The new passenger service, using three-passenger Sikorsky S.51 helicopters, of which the Corporation has three, will make two return flights each week-day; initially the service will be flown between Liverpool and Cardiff non-stop, but after the first month an "on demand" stop will be made at Wrexham, some 21 miles—roughly on track—to the south of Liverpool. No mail contract has been arranged for this service, which will operate only in daylight. The helicopters are expected to fly on direct track at a height of 1,500-2,000ft at a cruising speed of 85 m.p.h.

Fares will be : Liverpool-Cardiff, single £3 10s.; monthly return, £5 10s. Liverpool-Wrexham, 15s single and £1 return. Cardiff-Wrexham, £3 single and £5 return.

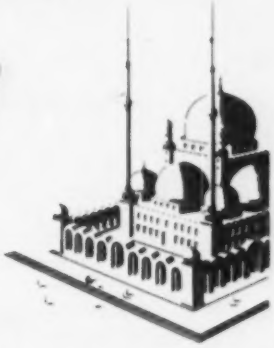
The scheduling of the flights is to be so arranged as to provide connections with B.E.A.'s Dakota services between Liverpool, Belfast and the Isle of Man, and the Aer Lingus flights linking Liverpool and Dublin. The timetable is as follows:—

Cardiff dep. 9.45 a.m. Liverpool arr. 11.30 a.m.
Cardiff dep. 5 p.m. Liverpool arr. 6.45 p.m.
(Wrexham arr. 6.20 p.m., dep. 6.35 p.m. Liverpool arr. 7 p.m.)
Liverpool dep. 9 a.m. Cardiff arr. 10.45 a.m.
Cardiff dep. 4 p.m. Liverpool arr. 5.45 p.m.
(Wrexham arr. 9.23 a.m., dep. 9.30 a.m. Cardiff arr. 11 a.m.)



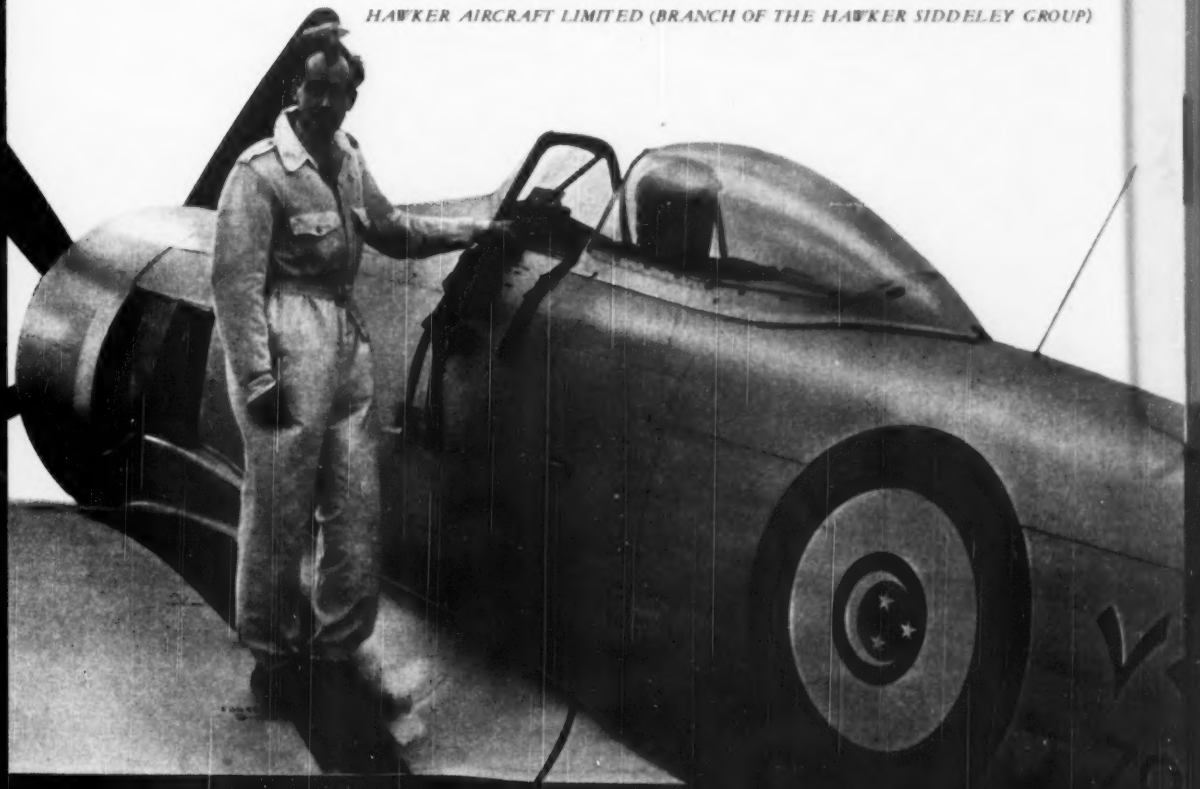
. . . and by night : A year later, the B.E.A. Helicopter Unit having moved to Westwood airfield, Peterborough, the first experimental night service was flown. The standard blind-flying layout included an illuminated cross-level bubble and a modified Sperry horizon with adjustable pitch-and-roll datum.

and 6½ hours later he was in Cairo!



HAWKER AIRCRAFT AGAIN. *Delivering a standard Hawker Fury to the Egyptian Government, Squadron Leader Neville Duke established a new London-Cairo Record. 2,205 miles at *334 m.p.h. (including refuelling stop at Malta).* **Subject to official confirmation.*

HAWKER AIRCRAFT LIMITED (BRANCH OF THE HAWKER SIDDELEY GROUP)



SR.A/1

FIGHTER FLYING

1947 Philippines

1950 HONGKONG ?

SAUNDERS—ROE

OSBORNE, EAST COWES, I.O.W.

HERMES IV In the Air

"Flight" photograph.

Impressions of Some Hours Spent at the Controls : B.O.A.C. Interior Layout

No. 35 OF THE SERIES

By THE EDITOR

CREW-TRAINING on the Handley Page Hermes IVs is about to begin at B.O.A.C.'s base at Hurn, and the first examples of these four-engined aircraft are now being checked out rapidly from the makers' airfield at Radlett in readiness for delivery. Twenty-three of the order for twenty-five for the Corporation have left the Cricklewood works and have reached the final assembly stage at Radlett. Delays in completion and consequent late delivery of these aircraft have, it is understood, been caused chiefly by the late arrival of several items of bought-out equipment without which the Hermes could not be put into airline service. Humidifying equipment for the cabins is still awaited. A Hermes IV, in the hands of S/L. Hazelden, H.P. chief test pilot, recently flew to Khartoum for tests in connection with a tropical endorsement for the C. of A.

Nearly eighteen months ago, in the issue date September 30th, 1948, *Flight* described and illustrated the Hermes IV in detail, and this mark of the aircraft remains the same in all essentials to-day. Similar in many ways but embodying improvement to the structure, the later Mark V, of which two are ordered, is especially distinguished by having four Bristol Theseus turboprops each giving about 400 h.p. more than the Hercules 763s in the Mark IVs. Hermes IVs will probably be the last aircraft to be delivered to a Corporation *via* the Ministry of Supply, who placed the order, and direct negotiation will be the practice in future.

As soon as the three parties concerned have signed the documents (and this may by now have been done), deliveries can begin. B.O.A.C. are anxious to receive the machines, and Handley Page to deliver them. At least six have been tested and inspected by the Corporation's representatives, and these can be flown to Hurn as soon as the word is given. Others will follow at the rate of one per week. Guaranteed performance figures have been comfortably exceeded by those machines which have undergone acceptance tests. The first example will be delivered by the makers and they will check out one B.O.A.C. crew. The training programme can then start in earnest. Ground-crew training is already well advanced.

Data for the Hermes will be found on page 289, but it may be mentioned here that the all-up weight is 82,000 lb and the span 113ft. A crew of five and two or more stewards are provided for, and 40 passengers can be accommodated.

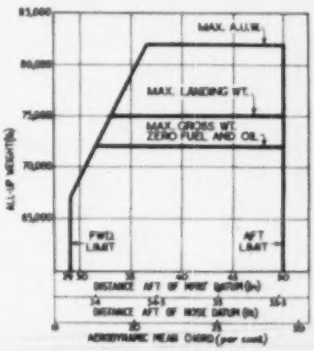
Recently I was able to take part in an acceptance test flight of some three hours' duration, and for about half of this period I was permitted to do the flying. Subsequently I made another flight from Radlett in order to try out some circuits and bumps. Apart from the experience of flying the aircraft myself, the first flight provided an ideal opportunity for seeing a Hermes IV put through its paces. Previously, more than three years ago, I had made a brief flight in the Hermes/Hastings tail-down prototype.

Quite obviously, the comfort of the B.O.A.C. captain and crew has received a lot of consideration. Take, for example, the pilots' seats. They are large and well upholstered, but particularly noteworthy are the adjustments. The whole chair moves up and down or fore and aft; the back can be upright or sloping; the head-rest is adjustable for height and position fore and aft; the arm-rests fold. Finally, rudder-control reach is adjusted with the aid of a small kick-out lever mounted on each pedal.

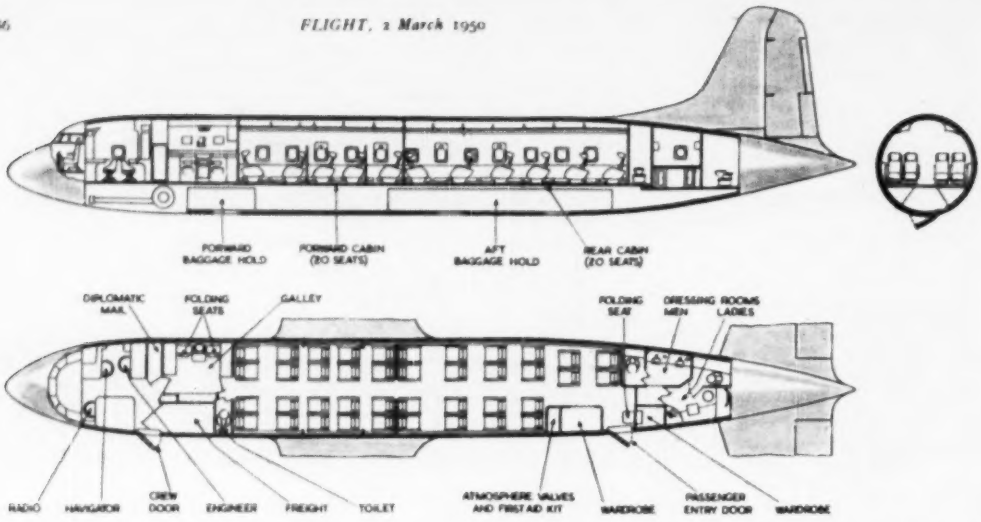
The pilots' instruments are limited to essentials—the blind-flying instruments, duplicated, directly in front of each seat, and engine dials located centrally between them (four r.p.m. indicators and four boost gauges). In addition, below these are the clock, air temperature gauge and the two brake air-pressure dials for the two separate circuits, and, below again, cabin height and pressure indicators.

On the central pedestal, and clearly visible in our photograph, are engine, airscrew and autopilot controls, flaps and undercarriage selectors, and trimmers. At the side are the lever-friction controls, main control locking lever and parking brake. Ahead of the pedestal, on a small extension panel, are the emergency flap and undercarriage controls and the airscrew reverse-pitch warning lights.

Roof panels situated immediately aft of the P.12 mag-



H.P. Hermes IV c.g. boundary diagram The c.g. aft limit is 50in aft of manufacturers' datum, at all weights. The c.g. forward limit is 29in aft of A.O.M.D. at weights less than 67,000 lb, and moves lineally with weight increase to 35.5in aft of the datum at 82,000 lb with the undercarriage down.



HERMES IV In the Air . . .

netic compass and roughly between the pilots, carry (main panel) ignition switches, feathering and fire-extinguisher buttons, switches for lighting and cabin signs; (subsidiary panels) I.L.S. control unit, V.H.F. control unit, and A.D.F. control unit. A few miscellaneous lighting switches, communication station boxes and windscreen wiper and de-icing controls are found at the cockpit side walls. The crew stations, illustrated overleaf, are also well and comfortably arranged.

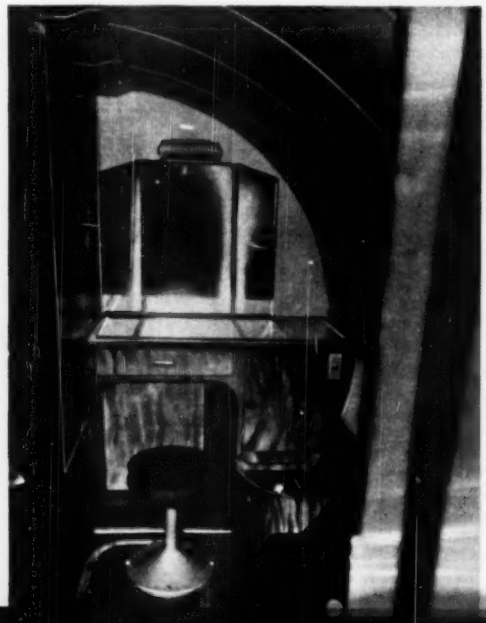
Our first take-off with F/L. Broomfield, H.P. test pilot, at the controls, was made in a strong gusty wind at an all-up weight of a little over 70,000 lb. The maximum take-off weight for the Hermes IV is 82,000 lb, and the maximum landing weight is 75,000 lb. On the Radlett airfield runways the safe limit for operation is about 70,000 lb. The aircraft, G-ALDG, was making its second flight and, though complete and with cabin fully trimmed, it lacked its special Vickers-built B.O.A.C. seats which will normally be fitted by the Corporation after delivery.

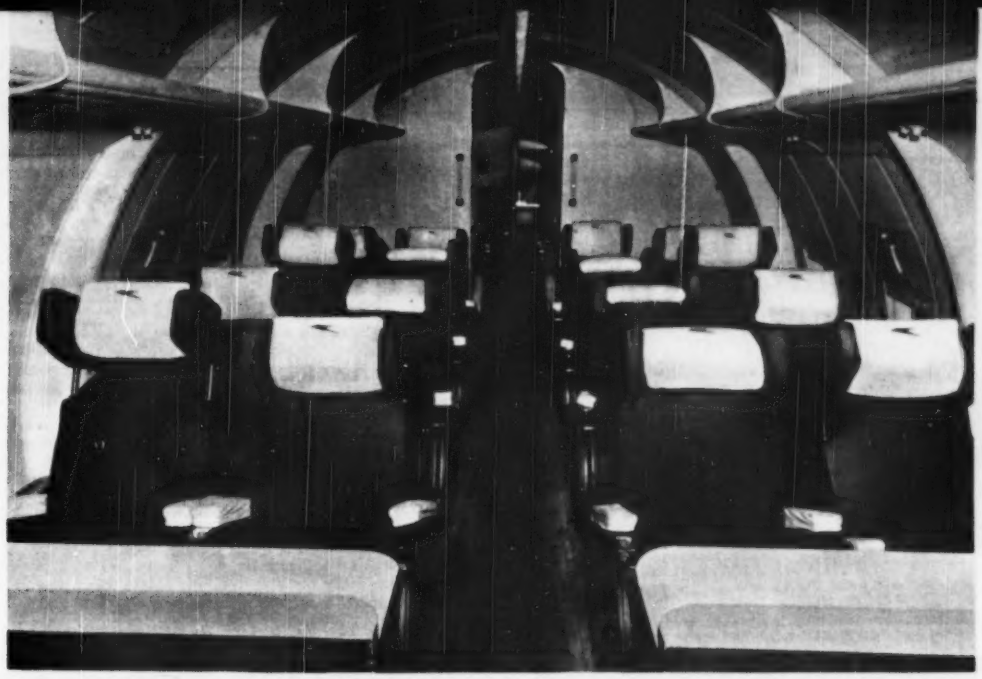
The c.g. position was approaching the forward limit (34-35in A.O.M.D.) of its travel, which amounts to nearly 20 per cent of the mean chord (see curve) and thus the fore-and-aft stick loads were probably not felt under the best circumstances.

As soon as we had taken off, we headed for the South Coast, climbing at about 145 kt I.A.S. until 15,000ft had been reached. At the reduced weight, the rate of climb was well over 1,000ft/min. This compares with the full-load rate of climb of a little over 800ft/min for the first 8,000ft, dropping to about 600ft/min at 15,000ft. Engine settings for the climb were for rated power, which is also the maximum climb power, and is obtained at 2,400 r.p.m. and 50in (10 lb/sq in) boost. While the change was made from M. to S. gear at about 8,000ft the boost was momentarily reduced to 30 inches.

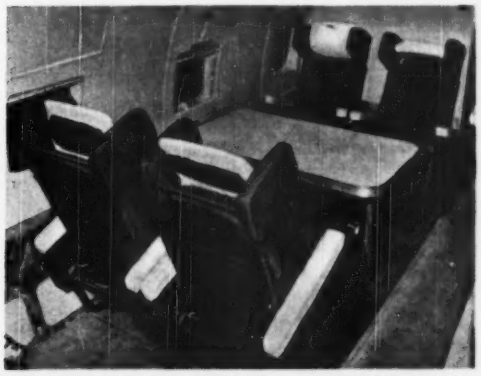
Once clear of a layer of rough air and broken cloud near the ground the Hermes climbed smoothly and quickly, and it seems that crews will be little affected by the noise and vibration of the engines. It is not quite fair to judge a part-furnished aircraft on these qualities, but it seems that the Hermes will be about average for a machine of its size fitted with four large piston engines. As would be expected, the noisiest area is the galley, adjacent to the engines and airscrews; elsewhere noise varies directly with

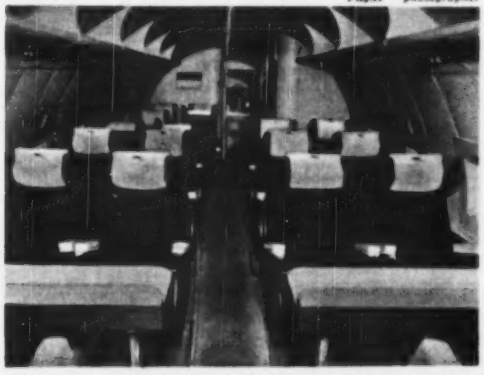
Interior details of Hermes accommodation. (Left) The galley, which is forward of the cabins, and (right) the ladies' powder room. "Flight" photographs.



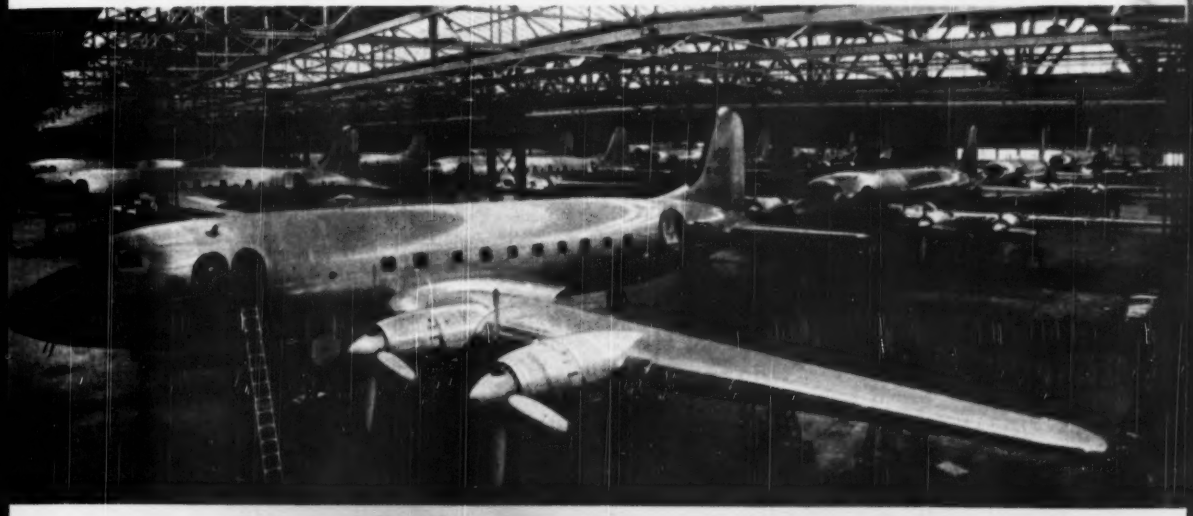


Three views of the cabins. Above is seen the full length of the divided passenger compartments, which seat forty ; below are a four-seat ensemble and a general view of the rear cabin with the main wardrobe (port side, forward of the door) and toilets in the background.
"Flight" photographs.





(*Below*) Final assembly at Radlett. Twenty-three Hermes IVs have now been delivered from the Cricklewood construction shops.



"Flight" photograph.

The simple, comfortable and well-arranged cockpit.

HERMES IV In the Air . . .

the distance from the engines. Several of the fairings and fittings—blinds, window frames and so on, of very light construction—set up a irritating buzzing, but that sort of thing can usually be remedied quite easily. The units of the air-conditioning system, located in the main coat compartment (port rear), which produce whistling noises, are in process of being boxed in.

Plenty of heat was available as soon as we had taken off, and by the time 15,000ft had been reached, the whole aircraft was warm and comfortable, with cabin altitude indicated as 1,000ft and differential pressure at 5½ lb/sq in. The windows are large enough to give most of the outside passengers a good view.

All this time our flight observer had been logging details of climb, checking rates with his stop watch, noting the trimmer positions and manipulating cabin-pressure controls in order to check their full and correct functioning. Next came some levels at E.C.B. (economical cruising boost, 38in, 2,400 r.p.m.). The altimeter indicated 16,000ft, the outside air temperature was – 10 deg C, and the I.A.S. was 191 kt. This is equivalent to a T.A.S. of about 245 kt.

For some time after this I had an opportunity to fly around as I wished while some miscellaneous airscrew-feathering tests were carried out. The airscrews are four-bladed de Havilland Hydromatics, 13ft in diameter. They are equipped for revers-pitch braking and have de-icing overshoes. One of the tests (to investigate the effect of a small mod.) was to feather No. 4 engine, the port outer, and see if, after a long period at high altitude, it would unfeather again. After a little hesitation it did. During the freezing process I circled around on three engines at 22,500ft and confirmed the impression that, for an aircraft of this size, and considering that there is no form of power assistance, the Hermes' controls are light and effective—more so than on any comparable aircraft which I have handled. The rudder is unexpectedly effective at low cruising speeds, and it is possible, without undue exertion and without the need for trimming, to hold the aircraft straight for some minutes when two engines are "out" on one side. The effect of feathering or unfeathering a single inboard engine is scarcely noticeable on the controls.

The trimmers, conveniently placed near to their indicators on the central pedestal, are sensitive and seldom require more than a few degrees of movement, even in asymmetric conditions.

It always seems to me a somewhat drastic action voluntarily to stall an aircraft of the size of the Hermes, although it happens to all of them during tests. The stall of the Hermes is certainly not alarming, and the aircraft protests at the indignity. The stall is officially described as "not clearly defined." First there is a little shuddering and buffeting, and this is followed by more of the same thing, but with increased severity. If one continues to haul back on the control, one receives a pretty rough ride, but there is only a gentle sink without wing drop to mark the stall. Recovery is rapid when the backward pressure is released, although it seemed to me that the buffeting momentarily increased as the speed started to rise, presumably because the elevator remained briefly in disturbed air. With "everything up" and a weight of about 69,000 lb the stall speed indicated was 98 kt. With wheels down and 80 deg of flap, the stall was very similar in feel, but the speed was only 82 kt. The height was about 12,000ft.

Later I tried stalling on a 30 deg banked turn. Again there was plenty of warning from buffeting, no tendency to drop the wing further, and immediate recovery. The indicated speed was between 105 and 110 kt and some aileron control remained all the time.

During most of the period spent at 22,000ft and over, No. 4 Hercules was feathered and the air speed remained at about 130kt I.A.S. with the other three engines still at E.C.B. This is remarkably good three-engine performance.

I then handed the controls back to F/L. Broomfield for a time while he checked various maxima. Normally 262 kt I.A.S. is the highest speed allowed. We made a short burst at 280 kt and found everything very smooth and satisfactory. Other tests included timing wheels and flaps up and down at the limiting speeds for operation (flaps, 187 kt, 40 deg; 161 kt, 80 deg; wheels 187 kt). Other items on the check list included brake pressure build-up and timing of feathering and unfeathering of all four airscrews.

Before returning to base I asked for a demonstration of the Smith's electric autopilot, the controls and indicators of which were situated beside my right knee when seated in the captain's seat. The power switches were already on and the instrument had had the necessary 45 seconds to warm up. This was indicated by the small amber lamp. Having trimmed the aircraft correctly, engagement simply entailed depressing the green button provided, and the aircraft was then under full automatic control. This was indicated by the extinction of the amber lamp and the illumination of a green one. The lamps are provided with a night dimmer.

The pilot's control for the autopilot is a fairly large, horizontal, knurled knob. For climb (up to 20deg), or dive (to 40 deg) it is pushed forward or backward in the normal sense. For bank, which is limited to 45 degrees in either direction, the rim of the knob is rotated. The autopilot is also provided with an elevator-trim indicator situated beside the control knob. Immediate disengagement occurs when the diminutive switch on the main aircraft control wheel is depressed.

After this it was decided that we had covered enough ground for one flight, and so we headed for base. The test pilot lowered the wheels and flaps, throttled right back, and demonstrated a somewhat unconventional rapid descent.

The actual landing which is described in these notes. This aircraft and several others are now ready for delivery to B.O.A.C.

"Flight" photograph.

"Flight" photograph.

A pleasing study of Handley Page Hermes IV. Its four close-cowled Bristol Hercules 763 power plants are especially shapely.

The angle and rate were quite spectacular, but the speed remained within the limits, and apparently the Hercules engines can be kept warm enough to respond immediately when circuit height is reached. Thick haze, typical of a winter afternoon in the London area, was settling over Radlett, and the circuit was necessarily kept very tight to hold the field in view. The pilot's confidence in the Hermes was clearly demonstrated, as was the high degree of manœuvrability of the aircraft itself, by his "split" approach.

As soon as another opportunity presented itself, four days later, the manufacturers permitted me to make another flight in a Hermes so that I could try some ground handling and the take-off and landing for myself. This time it was G-ALDH, the next machine off the line.

Taxying the Hermes presents no difficulties, although it always takes a little time to get used to the effect of brakes and throttles on any aircraft. The flying controls remain locked for taxying. On early machines the nosewheel steering has to be used in conjunction with the brakes and engines, the system being too high-geared (2 deg control-wheel movement for 1 deg of the nose wheel) or too low-powered to have any appreciable steering effect on its own. A mod. is in hand to remedy this. One feels that it would be as well, also, to move the box and switches (for radio), positioned just above the steering wheel, to save the captain's knuckles from wear and tear.

The brakes are smooth and very powerful, and they are operated by separate toe pedals mounted on the rudder pedals. Because the pilot sits close up to the windscreen —a feature which I personally favour on aircraft or automobiles—the view when on the ground or airborne is above the average, in spite of the fact that the windscreen panels are of only moderate size.

Once the necessary checks have been completed—and they are simple enough—there is no fuss or bother about take-off. I lined the Hermes up, unlocked the controls and released the parking brake; then acting upon instructions, to borrow the police phrase, opened up to rated power against the toe brakes before letting go. Momentarily, on moving off, I felt the fresh cross-wind catch the rudder (which until now had been locked, so that I had not felt the effect of the wind upon it), but I woke up and corrected easily enough in the first few yards before a swing developed. Full take-off power was used without delay, and with no further tendency of its own to swing, the Hermes accelerated rapidly. There was adequate rudder control within a hundred or so yards, so I transferred my attention from steering wheel to main controls, and sat until the end of the runway was a couple of hundred yards away. Then, with a speed of about 95 kt on the clock, a reasonably hard pull lifted the nosewheel and this movement was quickly followed by the aircraft flying off.

Several simple but quick actions followed: a touch of brake to stop the wheels spinning and the "up" button for wheels was pressed. Speed reached 120 kt very quickly, and power settings were reduced from 61in and 2,900 r.p.m. to 50in and 2,400 r.p.m. This represents a change from take-off output of 2,200 h.p. to climb power of 1,625 h.p. per engine.

At the same time as engine power was being altered by the pilot, aided by the engineer on his duplicate levers, the flaps were selected up and left to come in their own time. If the attitude of the aircraft is kept steady, the speed soon builds up to 140 kt as is required. I did not find it necessary to attend to trim until well established on the climb, and then only a degree of nose-up elevator trim was required. The pull to lift the aircraft off the ground

(*Concluded on page 295*).

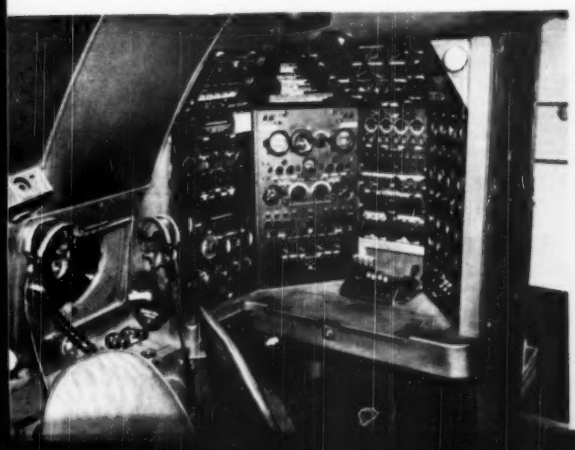
DATA FOR THE HANDLEY PAGE HERMES IV

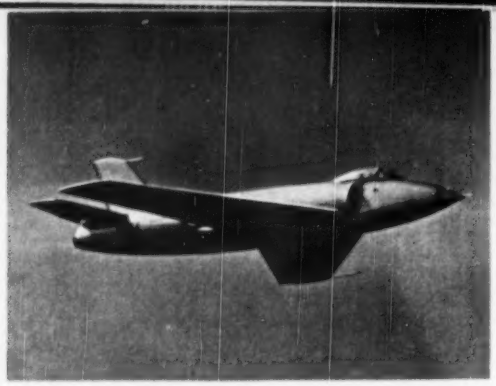
Four Bristol Hercules 763 14-cylinder Sleeve-valve Radials.

Span	113ft
Length	96ft 10in
Height (loaded)	28ft 7in
Tailplane span	43ft
Gross wing area	1,408 sq ft
Wing loading	58.24 lb/sq ft
Root chord	16ft
Tip chord	5ft 10in
Wheel track	24ft 8in
Wheel base	29ft 8½in
Passenger cabin length	44ft 5in
Passenger cabin width	10ft 3in
Passenger cabin height	6ft 3in
Freight hold volume	402 cu ft
Basic weight (40-seater)	53,137 lb
Max. all-up weight	82,000 lb
Max. power at F.T. altitude (5,250ft)	4 × 2,185 b.h.p.
Power loading	9.28 lb/h.p.
Max. speed at 20,000ft	357 m.p.h.
Max. range speed at 20,000ft	257 m.p.h.
Max. w.m. cruising speed at 20,000ft	287 m.p.h.
Climb to 10,000ft	12 minutes
Climb to 20,000ft	29.6 minutes
Max. range	3,625 miles
Fuel capacity, normal (2, 4, and collector tanks)	1,960 Imp. gall.
Fuel capacity, long range	3,260 Imp. gall.
Stalling speed, 82,000 lb, flaps up	113 kt (I.A.S.
Stalling speed, 82,000 lb, flaps 180 deg. u/c down	96 kt
Take-off to 50ft (guaranteed at 82,000 lb)	1,400 yards

Neat instrument and radio installations. Left: the flight engineer's panel and navigator's seat; right: the radio officer's station.

"Flight" photographs.





Supermarine 510

Design Analysis of a Swept-wing Aircraft for High-speed Research

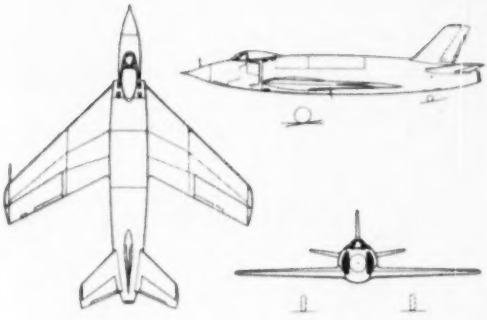
THOUGH for the last five years we have had fighters which, in *fighting performance*, have been unmatchable, *vis-à-vis* the fighters which are now in production in the U.S.A., and in Russia, our showing is far from being everything that could be desired. As pointed out in the leading article of our January 26th issue dealing with the world's military aircraft, the existence of a new type of Soviet fighter, already in service and of very advanced aerodynamic design, has been confirmed. Furthermore, there can be little doubt that, if adequate thrust is available (e.g., from a Nene), such a machine might match or even excel the performance of the North American F-86 Sabre—and before delivery each Sabre is flown at a speed in excess of 670 m.p.h.

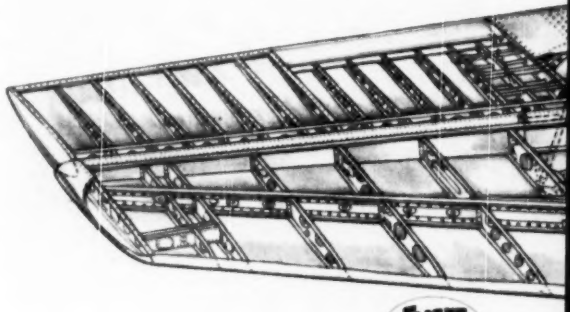
The only British aircraft which can match speeds of this order are research types. Fortunately, despite the recognized fact that it takes an uncomfortably long time for an aircraft to travel the road between the prototype stage and squadron service, the very existence of the Vickers-Supermarine 510 and Hawker 1052, and the considerable experience gained with them, make it certain that, if we were faced with an emergency in the relatively near future, fighter versions could be put into production with the minimum of delay.

So far as the 510 is concerned, the fact that it is essentially an Attacker fitted with swept-back wings and tail surfaces, but with research instrumentation instead of military equipment, means that its transformation into a formidable fighter would be an essentially simple matter.

What perhaps is less patent is that the 510 is the latest physical expression of a continuous line of aircraft which started with the original Spitfire. Briefly, the saga can be epitomized in the man who said he had worn the same waistcoat for twenty years and that, apart from having the back renewed three times and the front renewed twice, it was as good as new. The first change came when the Spitfire was powered with a Griffon in place of the original Merlin engine. When the elliptical wings which made the Spitfire unique were displaced by a straight-edged, thin-section, laminar-flow wing of greater stiffness, and the fuselage as well was changed, this heralded a new name, Spiteful. Certain Spiteful features were then incorporated in some later marks of Spitfire.

The advent of the turbojet numbered the days of the piston-engined fighter. But, by the same token, it offered a first-class opportunity of wedding the thin wing of the Spiteful to a new fuselage incorporating a turbojet power unit, and in July, 1946, the Supermarine 392—later to become known as the Attacker—made its first flight. This

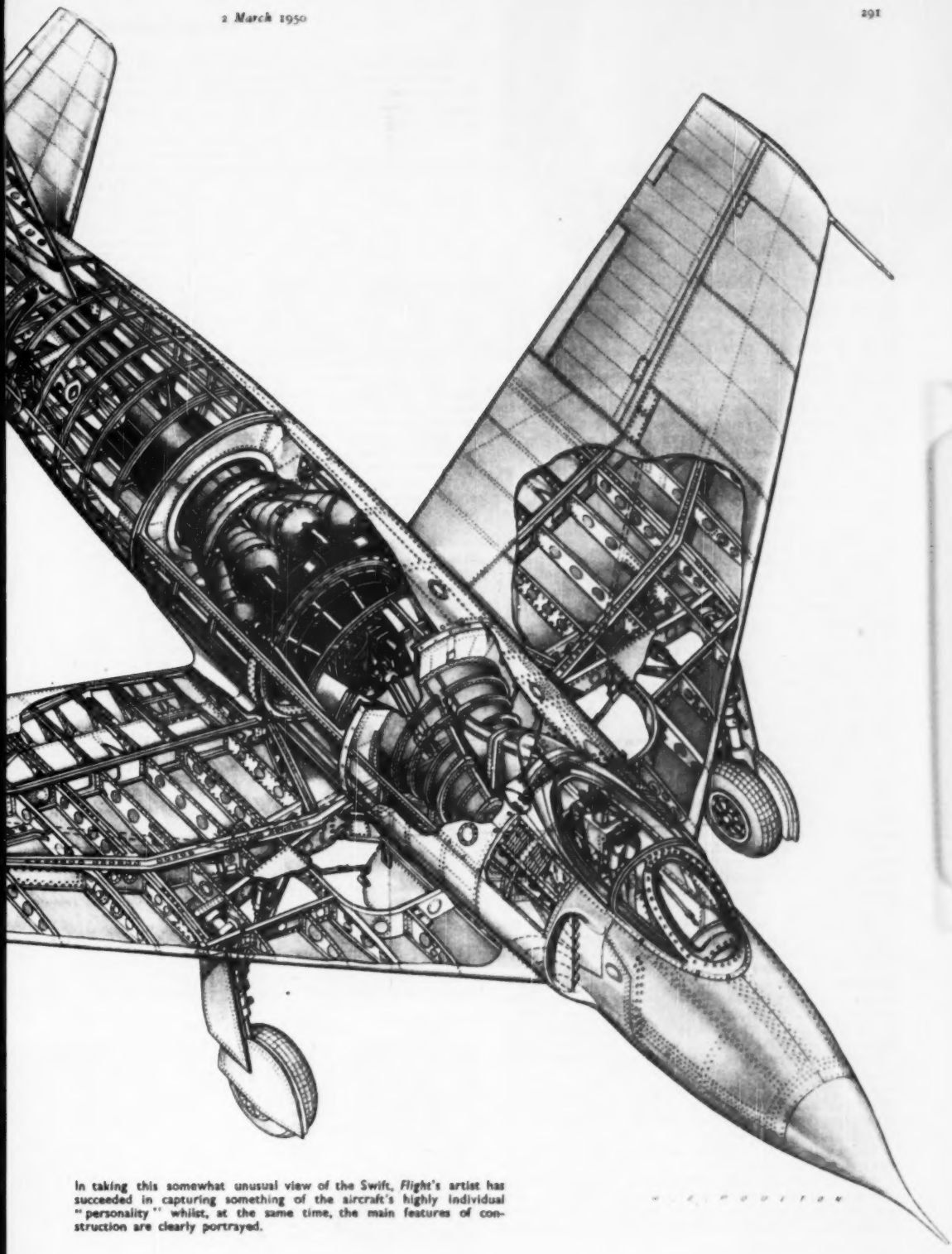




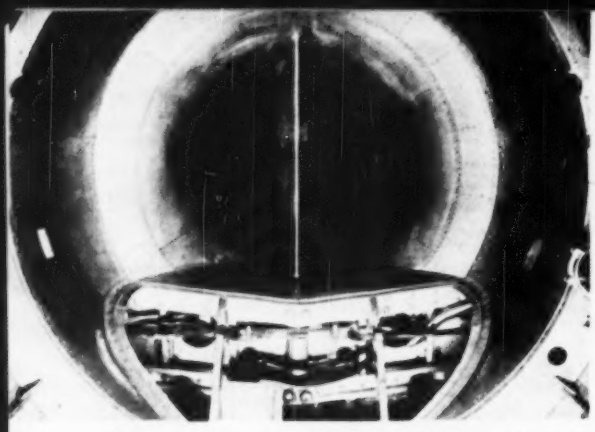
SUPERMARINE 510 DATA

One Rolls-Royce Nene turbojet, 5,000 lb static thrust

Span	31ft 8.5in
Length	38ft 1in
Height, tail down	8ft 9.72in
Height, tail up	12ft 3.96in
Ground angle	9 deg 42 min
Wing area	273 sq ft
Sweep-back (at quarter chord)	40 deg
Aspect ratio	3.68
T/c ratio	10 per cent
Incidence	2 deg 30 min
Dihedral	2 deg
Undercarriage track	14ft 2.5in
Tailplane span	12ft 7.2in
dihedral	10 deg
area	61.1 sq ft
Elevator area	15.6 sq ft
Fin and rudder area	40.5 sq ft



In taking this somewhat unusual view of the Swift, *Flight*'s artist has succeeded in capturing something of the aircraft's highly individual "personality" whilst, at the same time, the main features of construction are clearly portrayed.



View forward from plenum chamber, showing duct bifurcation.

Supermarine 510 . .

aircraft, like the Seafire and Seafang complements of Spitfire and Spiteful, was destined to be developed into a Naval type and, in fact, production is now being geared up at the Vickers-Supermarine factory at South Marston. The first batch of production Attackers can, therefore, be expected to be delivered to squadrons within the next few months.

So excellent a body design and power installation was obviously an extremely convenient, as well as an appropriate, foundation upon which to base full-scale experimentation with swept wings, and in 1945, when the need for flight investigation into high-speed phenomena was recognized as a matter of no inconsiderable urgency, the Supermarine company started on a design study for an Attacker fuselage equipped with swept wings and tail surfaces. This led to the issue of an official specification and a development contract for two aircraft and, just one year and nine months later (on December 29th, 1948) the 510, as the new aircraft was designated, made its maiden flight in the hands of Lt.-Cdr. Michael Lithgow, the company's chief experimental test pilot.

A fully detailed description of the Attacker was published in the May 15th, 1947, issue of *Flight*, but in order to refresh readers' memories as well as to serve those who did not read the original article, a brief recapitulation of the salient features of the fuselage structure and layout—as it exists in the 510—may be of value.

In fundamental shape, the fuselage is a solid of revolution in the form of an ellipsoid with a fineness ratio of 7.8 : 1. The basic shape is, however, modified by the necessity to provide intakes for the Nene, a canopy for the cockpit and a hole for the jet efflux, but despite these imperatives—or, rather, as a result of the excellence of their design—the deformation of the ideal is slight. The fact that the fuselage tail is cut short for the jet-pipe outlet puts the fineness ration of the body up to 7.5 : 1, but this is in part compensated by an addition which modifies the basic shape in rather a startling way—namely, the "needle" nosecap. Probosces of this type in greater or lesser exaggerated forms were introduced in the U.S.A., but we believe we are right in stating that the primary purpose was the root fairing—and strengthening—of a pitot-head extension. At the present time, the 510 carries its pitot-head on the port wing-tip but that this may be transferred some time in the future to the nose extension is not impossible. For the moment, however, the nose point of the aircraft is put to no definite purpose, although its intrinsic shape may well provide some aerodynamic advantage; this is a matter of some uncertainty but, aerodynamically advantageous or not, the 510's detachable beak is æsthetically arresting and certainly does not detract from the very beautiful lines of the aircraft.

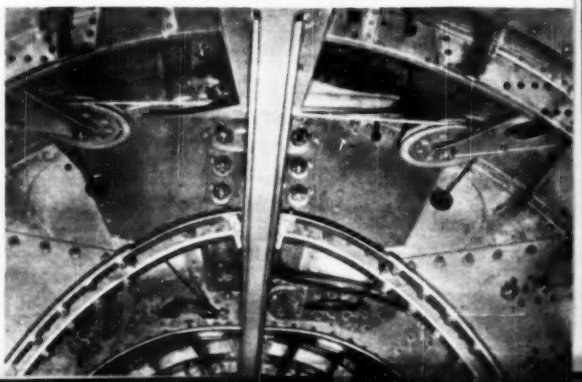
The way in which the fuselage form was actually decided is rather interesting. In the initial instance, a maximum diameter of 60in was fixed as being the smallest dimension which would accommodate the Nene. In connection with this, the position of the wing spars was then determined, which in turn dictated the requisite position of the tail surfaces and the cockpit. The result was a general determination of fuselage length in relation to diameter, and the actual curvature of body form was selected on this basis from a survey of the best data relating to form drag available at the time.

Structurally, one of the more unusual features of the 510 (and the Attacker) is the transition between cockpit and fuselage proper. In side elevation, there is nothing unusual in appearance, but in plan it at once becomes evident that the cockpit is, in fact, virtually a separate little nacelle, cantilevered from the main fuselage body. This, of course, arises from the presence of the intake trunks which, passing behind the cockpit, necessitate a break in structural continuity. The space between and on each side of the inlet ducts is devoted to fuel-tank stowage and, therefore, the top skinning of the fuselage immediately aft of the cockpit is fashioned as a tank-access door. In view of the cantilevered cockpit, however, this door had to be designed as a stressed member, for which reason it is fastened to the bounding frames and longerons by healthy-sized screws which accommodate the shear loads involved. The skin plating of the cockpit/fuselage underbelly is continuous and, therefore, helps in some measure in the accommodation of the cantilever moment, but the very size of the intake orifices means that the degree of cockpit load-transfer shared by the skinning around the inlets is relatively small.

In view of the contemporary interest in flush intakes, a certain amount of argument has arisen as to whether the intakes used on the Attacker and 510 can justifiably be regarded as being of flush type. Certainly, if the maximum-beam line of body curvature in plan form is continued across the intakes, it is seen to support the "pro" side of the argument; there is, in fact, little doubt that, if the top and bottom fillets of the intake orifices were extended forward in conformity with the curvature of the body, the intakes would undeniably become flush. Whatever the merits of the intake form may be in deserving one or other appellation, the fact remains that they are admirably suited to the duty required of them; that the intake efficiency at the plenum chamber entry is well over 90 per cent is well worthy of note.

The cockpit nacelle is itself unusual in being of "lobster-claw" construction, in light alloy sheet 0.56in thick. The nose volume ahead of the rudder pedals provides ample stowage space for the (relatively) very large automatic observer and variety of test instrumentation. As to cockpit layout, there is not a great deal to be said beyond remarking on the neatness and care which have patently been exercised in its planning; a Martin-Baker ejector seat is fitted. The screen and canopy arrangement is, however, somewhat unconventional. To take the screen first, this is a ¾in-thick multi-ply glass sandwich which is, of course, optically flat and bullet-resistant, but in front of it is fixed a ¼in-thick compound-curved glass fairing-panel, by means of which the aerodynamic properties of the cockpit covering are usefully enhanced. The flanking screens and the jettisonable canopy proper are all fabricated in blown Perspex and, equally, are all of double-cavity-wall construction. The purpose of this elaboration is to mitigate the effects of misting, and toward this end the inter-Perspex cavities breathe into flexible reservoirs through silica-gel desiccant packs. Anti-misting qualities are also

Gantry in rear fuselage to facilitate jet-pipe installation.



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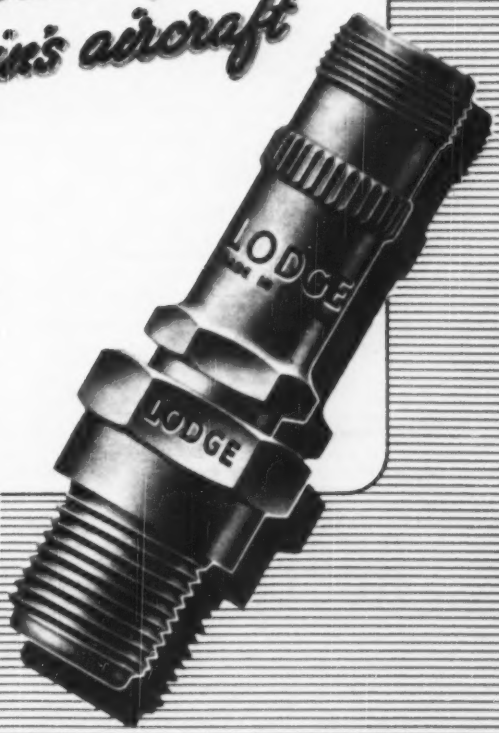

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Supermarine 510 . .

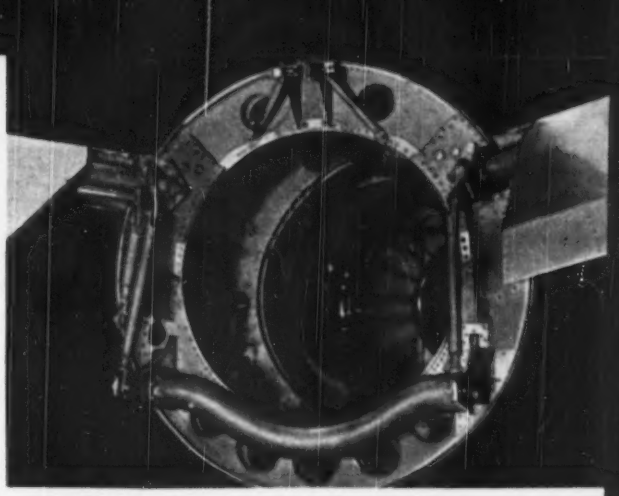
vested in the front screen arrangement, for the air space between the curved outer and flat inner screens, although ventilated to atmosphere, is aspirated in so indirect a fashion that the gradient between ambient and cockpit temperatures is undoubtedly made less steep.

The cockpit is designed for a pressure differential of 3½ lb/sq in—which, for example, gives a cockpit "height" of 26,000ft at an actual height of 50,000ft—the air supply being taken from the Nene compressor. Normalair control equipment in the form of a constant-flow valve and a slave unit is used, and inflatable-tube seals (also fed from the engine compressor) are fitted both to the cockpit canopy and the plenum chamber roof-door. This latter member, like that serving the fuel-tank bay immediately ahead of it, is a load-carrying unit and, as such, is similarly fabricated with built-up top-hat frames, together with Z-section stringers; this door, too, is fastened by large, shear-loaded screws.

The annular bulkhead which forms the rear wall of the tank cell has its lower segment spanned by the bridge-booms which serve to unite the main spars of the port and starboard wing panels. This bulkhead can be likened to a collar surrounding the confluence of the twin air-entry ducts, and these unite downstream of the bulkhead to form a "trumpet-mouth" diffuser into the plenum chamber. It is here that the maximum diameter of the fuselage occurs, the figure of 60in being decided upon in consultation with Rolls-Royce as being the minimum which would allow the requisite flow to the rear face of the double-sided compressor. In this connection, mention should be made of the anti-depression vents in the door-roof of the plenum chamber. As may be imagined, when the engine is started, a pressure drop of some magnitude immediately occurs in the plenum chamber and to relieve this, the spring-loaded flaps in the top of the fuselage are incorporated. These close automatically when a forward speed of *circa* 150 m.p.h. creates sufficient ram effect to equalize plenum chamber and ambient pressures. The rear wall of the plenum chamber is formed by an annular diaphragm surrounding the turbine outlet, the diameter of the hole in the bulkhead being sufficiently large to allow the escape of plenum air past the jet-pipe to provide the requisite cooling flow through the tail portion of the fuselage.

In construction, the rear fuselage is a simple semi-monocoque of, in the main, channel frames and Z-section stringers, but in way of the fin and tailplane spars the frames are substantial built-up box-section units which, in effect, become annular bulkheads. An ingenious feature of the rear fuselage is the ridge gantry by means of which the long tailpipe is installed and, conversely, removed. The gantry takes the form of a lipped-channel-section "railway" carried along the centre-line of the upper portion of the rear fuselage and, on installation, the forward end of the tailpipe is suspended from a roller unit on the railway. In this way, the pipe can be run forward until it engages the turbine outlet shroud; when union is effected, the suspension unit supporting the pipe is slackened off so that the gantry is not debited with the weight. The rear end of the jet-pipe is supported on a swing-link yoke immediately abaft the tailwheel retraction box.

The Vickers twin-tailwheel unit is anchored by a system of yoke brackets to the base of the fuselage double frame which, at its head, serves as an anchorage for the foot of the front fin-post. The use of a tailwheel-undercarriage layout has much to commend it; it is lighter than a nosewheel configuration and the tail-down attitude of the aircraft on landing promotes so much drag that fully 50 per cent of the energy dissipation required to bring the aircraft to rest is provided aerodynamically. If, however, official requirements demanded it, the 510 could easily be modified to employ a nosewheel layout. This would, of course, necessitate moving the main undercarriage legs rearward, but the modification would not present any real difficulty. As just mentioned, however, such a transformation would throw a very greatly increased burden upon the Dunlop plate-type wheel brakes.



Detail showing elevator transmission interconnection.

The continuity of design between the original Spitfire and the present 510 has already been touched upon, and is of particular point so far as the tail surfaces are concerned. The positional relationship between the tailplane mean chord and wing as used on the Spitfire was eminently successful and, understandably, the company wished to preserve this quality when designing the Attacker. Equally, it was felt desirable to eschew the structural complexities attendant upon a fin-mounted tailplane. Therefore, in view of the low position of the tailplane mounting relative to the wing, it was necessary to cock up the tailplanes at a dihedral angle of 10 deg. The tailplanes and fin, like the wing, are swept back at 40 deg—measured at 0.25 per cent chord—and all three tail surfaces are structurally similar in being built up with D-box leading edges, pressed channel spars reinforced with taper-machined light-alloy extruded booms, and pressed sheet diaphragm chordal ribs liberally pierced with flanged lightening holes. In each case, the inter-spar root-rib is of particularly massive construction, with a heavy-gauge plate-web and extruded booms, attachment to the spar booms proper being effected through machined fork-and-eyebolt fittings.

The movable tail surfaces are also essentially similar in construction, the intrinsic differences being concerned with the articulation for the various tabs. At its inboard end, each elevator is furnished with a torque tube, flange-bolted to the root-rib, and arms extending rearward from each torque tube are universally pivoted to dependent struts which, at the foot, pick up arms extending rearwardly from a bowed interconnecting tube carried in brackets off the rear face of the fuselage frame to which the tailplane rear spars are attached. The bowing of the cross-tube is necessitated by its having to pass under the jet-pipe. Only the port elevator is furnished with a spring tab, its starboard fellow carrying a conventional pilot-operated tab. The rudder tab is a trimming surface, but is electrically operated by means of a Miles actuator housed in the fin.

Whilst on the subject of controls, it is appropriate to mention that all control motion of the transmission linkage in the cockpit is rotary, the purpose being to diminish the pressurization sealing problems as much as possible. From the cockpit, however, the control linkage changes to push-pull tubes and is carried inside a duct back to a point midway between the wing spars, where the aileron controls respectively branch to port and starboard.

When the design of the 510 was first given serious consideration, it was decided that a wing sweep-back of 40 deg at the quarter chord was as much as could be undertaken without running into undue handling troubles at the low end of the speed range. In point of fact, when the aircraft made its début the wings embodied fixed slots extending about three-quarters of the span inboard from each tip. As flight tests progressed, however, the slots were progressively reduced in length until, eventually, they were entirely deleted. It says much for the design of the wing that the low-speed tip-stalling characteristics should be as good as they undoubtedly are. The aerofoil section chosen was selected only after a considerable investigation of all the data available at the time. It is, in fact, an

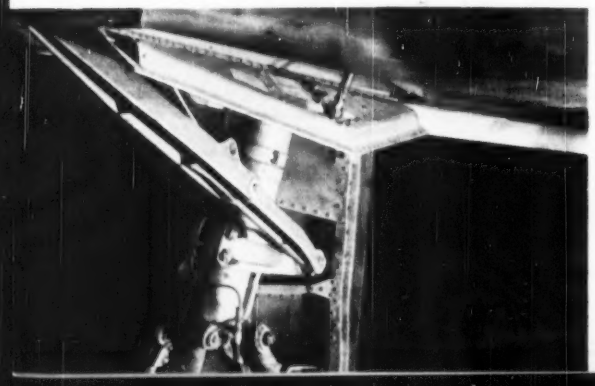
Supermarine 510 . .

N.P.L. 10 per cent t/c symmetrical section which, as well as having the advantageous well-rounded leading-edge profile for low-speed stalling, was found to have its greatest depth at a point (35 per cent chord) where it was convenient for spar pick-up. In addition, the section provides a fairly narrow trailing-edge angle which, of course, is beneficial in terms of control characteristics at the higher Mach numbers.

As may be seen from the main drawing illustrating this article, the wing spars are cranked. In the case of the main spar, the root crank is through an angle of 28 deg, whilst the second crank, immediately outboard of the undercarriage anchorage, is through 14 deg. The use of light-alloy extruded booms spanning the fuselage to bridge the port and starboard spar roots has already been mentioned, and the union is effected with multiple high-tensile-steel bolts. The main spar itself consists of a flanged web-plate and massive, rectangular-section extruded booms of light-alloy which are vertically drilled with numerous lightening holes. The outboard portions of the spar booms are taper-machined to a die-away point at approximately one-third aileron span, the remainder of the spar out to the tip being flanged-web continuation. As such, the rear spar does not crank at the root, the change of direction being vested in the attachment fittings. The spar itself is of I-section, made up of two pressed-channel members back-to-back, this form obtaining out to the inboard end of the aileron, from which point outboard the front channel ceases and the rear channel runs on out to the tip.

In conjunction with the inter-spar chordal ribs and the heavy-gauge skin panelling, the spars make up a torsion box of very considerable strength. However, the root cranks make it necessary to employ an inter-spar root rib of relatively massive construction. This member is made up of a pair of pressed-channel web-plates, between which, top and bottom, are extruded rectangular-section booms which, like the main-spar booms, are vertically drilled with lightening holes. Attachment to the main-spar is made with tanged eyebolts, themselves through-bolted at the tangs to the rib booms, with the eyebolt shanks piercing the main-spar booms. At its opposite end, the root rib terminates in machined fork-fittings which are bolted to lugs on the transfer member which unites the rear spar to the pick-up fittings on the fuselage frame at this station.

From the wing root, the leading edge out to the main-spar crank is largely taken up by the undercarriage. The head of the telescopic oleo-strut is anchored between two machined fittings carried off a double nose-rib and the pair of ribs which run inboard to form the well for leg retraction. These latter ribs have plate-webs with machined booms and serve to dissipate subsidiary loads from the undercarriage anchorage, the main loads being taken out through the doubled chordal-ribs. The undercarriage jack (which, like the main and tailwheel oleos, is a Vickers component) is carried spanwise in the leg-well with its rod picking up to the breaker radius-strut. In the space between the leg-well and the main spar is fitted an "envelope-flap" dive-recovery flap which is piano-hinged along its leading edge and retracts flush into the under-surface skinning. Actuation is by a small jack anchored on the front face of the main spar and with its rod pin-jointed direct to the flap. Outboard of the spar crank the leading-edge ribs are pressed-channel diaphragms, and inboard of the aileron the trailing edge is formed as a roof over the flap recess with the skin carried on cantilever bracket-ribs of channel-section. Skin panelling over the main torsion box of the wing is 12-gauge, whilst the leading edge is skinned with 16-gauge panels. The aileron shroud, which is a separate skin extension behind the rear spar, and the panelling over the flap recess, are both carried out in 18-gauge.



Detail showing port undercarriage strut and dive-recovery flap.

Landing approach is helped by flaps of generous area.

Use of a tailwheel undercarriage in conjunction with the swept-back wing has necessitated the outboard half of each flap trailing-edge being cut forward to allow ground clearance. The split-type flaps themselves are, in a sense, also of slotted type, in that they are each swung on three hinges which are set forward so that, when the flaps are lowered, their leading edges are below the under-surface of the wing. To the same end, the flap is given a cambered upper-profile and has a skinned top-surface extending back approximately to 50 per cent chord, the remainder being a single (lower) surface carried on tapered channel ribs. Flap actuation is by a hydraulic jack, carried off a box bracket in the third rib-bay outboard from the wing root, with the jack rod picking up a plate bracket at about mid-flap span, the centre hinge of the flap being bolted off the bracket base. The port and starboard flaps are mechanically interconnected by a cable system.

The 510 is furnished with slotted ailerons, built up with a D-box leading edge and pressed-sheet chordal-ribs, each surface being swung on three hinges. The aileron control system is distinctly unusual in that a Servodyne unit is fitted in the cockpit, and in addition to this power-assistance system, each aileron is fitted with a spring-tab. From the central T-lever at the end of the control duct in the fuselage, the aileron control linkage is formed by push-pull tubes which run spanwise and, at about half-way between the spar cranks, pick up to a triangular transfer-plate pivoted (in brackets) at the apex. From the outboard corner of the transfer-plate, another push-pull tube runs across the inter-spar space roughly parallel to the wing leading edge and terminates at a bell-crank which gives a movement reduction-ratio. From this, a further tube runs back to the inboard root of the aileron and there picks up the spring-tab mechanism. The spring system is housed on the aileron hinge-axis, the input control rod picking up to the tip of a 4½in lever, the base of which is bolted to the flange of a transfer tube. At its inboard end this transfer tube is pinned to the root of a torsion bar housed coaxially within it, the outboard end of the bar being anchored to the aileron structure. Connection to the tab is made with a push-pull tube picking up to the outboard end of the transfer tube. Lateral trimming is provided by a small electrically actuated tab outboard of the spring-tab on the port aileron, the actuator being housed in the aileron leading edge.

Unusual as the aircraft's aileron control system may be, those who saw Michael Lithgow's uninterrupted series of high-speed slow rolls at the S.B.A.C. display at Farnborough last year will need no convincing as to the system's effectiveness. The success of the flight trials of the 510—which have now been going on for about a year—leave no room for doubt that Supermarine aircraft of the future will carry on the degree of advance already established in the development of the Spitfire-Spiteful Attacker-510 line.

C. B. B.-W.

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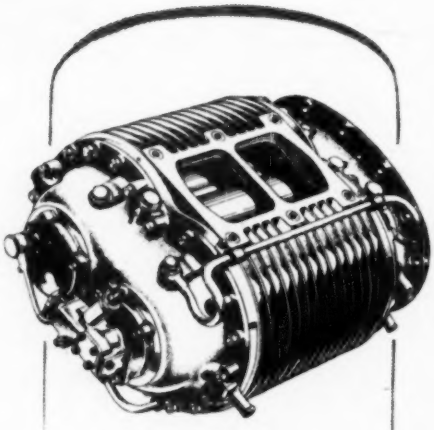

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SAILPLANE DESIGN and OPERATION

*Some Concise Comments by R.Ae.S. Graduates**

HIGH-PERFORMANCE GLIDERS

By F. G. IRVING, B.Eng., D.I.C., Grad.R.Ae.S.

ALTHOUGH allowance must be made for the effects of the war, no glider has yet been made in this country with a performance better than that of the German Weihe of about 13 years ago. The Weihe has a profile drag coefficient of 0.016, and uses a Göttingen 549 wing section. In these days of low-drag sections, it should be possible to improve that figure, and by cleaning up the wing-fuselage junction, deleting external aileron horns and so forth, something of the order of 0.012 should be feasible.

A logical design procedure would then be to aim for the best mean cross-country speed for some chosen "average thermal strength." How strong? Probably, for this country, not more than 5ft/sec true, assuming, say, 0.5ft/sec "down-draught" between thermals. Proceeding in the manner explained by K. G. Wilkinson in his lecture [R.Ae.S. Graduate and Student Section, September 28th, 1948], the optimum wing loading for these conditions can be found, the assumed value of C_{D_0}, and the highest aspect ratio which is structurally reasonable. Given suitable structure-weight data, a suitable span can then be chosen. Apart from the usual assumptions about weight of pilot, and so on, it would be wise to allow for about three times the amount of miscellaneous equipment considered by any previous designer. Oxygen, batteries, rotary converters and radio should not be accompanied by prickings of conscience about all-up weight.

It seems probable that the final answer would involve a span of about 65ft, an aspect ratio of 20 or 22, a wing loading of about 4.5 lb/sq ft and the use of flaps when circling in thermals. One would also like a higher rate of roll than is at present usual, more directional stability, a rudder which does not over-balance in a side-slip, 3in more elbow-room and a maximum aero-towing speed of about 80 m.p.h. It must also be at least as easy as the Weihe to rig, and a good deal more accessible for adjustment of turnbuckles and so forth. Some method of construction, such as that called for by H. Kendall in the design which won the B.G.A. two-seater design competition would help to keep the price practicable.

THE ICING OF SAILPLANES

By P. RIVERS, B.Sc.(Eng.), Grad.R.Ae.S.

WHILE strenuous efforts are being made to protect all aircraft likely to fly in icing conditions, high-flying sailplanes, which in summer are more likely to meet icing than any aircraft, are unable to carry any general protection whatsoever.

The lack of a power supply rules out all forms of wing protection, mechanical, fluid, or thermal, but so far no major aerodynamic trouble has been caused by ice-formation, as the low speed of the sailplane renders the actual catch of water small, and keeps the ice-formation down to a strip a few inches wide along the leading edge. The only danger in this direction lies in the possible jamming of the controls by ice forming on exposed control horns or on the tips of horn balances: the former can be shielded fairly easily, while horn balances are going out of favour on advanced machines.

The icing-up of air brakes is more serious, since these are the sailplane pilot's stand-by if he reaches a dangerous high speed condition while flying blind: they must be kept free at all costs. They can be prevented from icing in the closed position by gentle exercising of them every minute or so, but they ice up rapidly when out, so that a pilot may have to land with the brakes jammed open.

The main concern of pilots is to keep their blind-flying instruments operating. For this reason electrically driven turn-and-slip indicators are used in preference to venturi-driven ones. The air-speed indicator is still vulnerable, however, as it must operate from a venturi or pitot tube, which will ice up. Pitot tubes rarely block during icing, as the ice forms a continuation of the tube, but during descent the ice thaws and runs back into the tube. Heated pitot-static heads for power aircraft consume 70-100 watts, so are impracticable for sailplanes: most of this heat is required to keep the complete head ice-free.

The cockpit static pressure is accurate enough for sailplane use, so the problem becomes one of protecting only the tip of the pitot tube. Recently a number of people have concentrated their attention on this point, and it seems possible that soon this bogy also will be laid.

* *Published in the Graduate and Student Section of the "Journal of the Royal Aeronautical Society," February, 1950*

HERMES IN THE AIR (Continued from page 289)

only needs to be held for a few seconds. Wheel retraction seemed to have no appreciable effect on trim, and the flaps are linked with the elevator tabs and automatically compensate for trim change when moving up or down. For example, the control wheel itself moves backwards a little as flaps come in, and the tabs alter the trim. The flap lever is gated and has a maximum lift (40 deg) setting and a half-way setting between this and fully (80 deg) down.

In spite of its size (and assuming, of course, that no emergencies arise to require the attention of an engineer) the pilot of the Hermes has all the essential controls at his finger-tips and could fly the aircraft on solo circuits.

After the take-off I flew the aircraft around for a few minutes to "cool off and build up," and then settled down at about 1,400ft for a final circuit and landing. The aircraft needed persuading down to a speed of 180 kt, even when well throttled back, but once the wheels had been lowered quite high power—2,400 r.p.m. and 30-32in boost—was required round the last half of the circuit to maintain 150-160 kt. For the last turns I used 40 deg of flap and kept the speed at 140-150 kt. There was plenty of drift on the final approach, and with full flap and a speed of 115 kt, between 25 and 30in of boost were required to maintain speed and a steady descent. If speed is allowed to get too low the sink is pronounced and a good deal of power is required for recovery.

Over-the-hedge speed of 105 kt (and I cut things pretty fine to get a short touch-down) was adequate. Both the drift and a flock of birds—at least one of which we hit with a pronounced thud—attempted to upset my landing, but the Hermes touched down firm, fair and square without much assistance from me, and showed no tendency to bounce or swing. It had required a good strong pull and plenty of aft trim to keep the tail low for touch-down, and it was simplest to let the nosewheel touch-down very shortly afterwards. I did not use the powerful brakes until fairly late on the run but was able to stop smoothly and in plenty of time to turn off.

The pilot's view on the approach is good, and even on the final turn it is possible to keep the runway well in view. The natural approach is, however, rather long and shallow, and compared with some contemporary American airliners the Hermes would be considered under-flapped.

It is a matter of regret to everyone concerned that the Hermes IVs are not already in service, but even so they are expected to prove useful members of the B.O.A.C. fleet for several years to come. Above all, the Hermes is a very British aircraft in conception, appearance, and particularly in the way it handles. There are still all too few British airliners flying on world routes and too many foreign aircraft flying for British operators. (Delivery of the first Hermes is reported as we go to press.)

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Thunderstorm Flying

YOUR correspondent, Capt. Lovelock [Correspondence, February 23rd], and I seem to be in complete agreement about the dangers of tropical cu-nim. I do not know why he thought I had suggested the "500 feet" method as being suitable for airliners, because in my original letter I specifically stated that obviously it was not.

Like Capt. Lovelock, I am convinced that there is no haven to be found much below 30,000ft, and that in high-speed jets some sort of radar cloud-warning system would appear to be obligatory. Some of these tropical cu-nims go up to 40,000ft, and to hit one of those at 500 m.p.h. would, I maintain, be hazardous in the extreme. In daytime these clouds can be seen and avoided. At night, without radar, one could be in them without any warning at all.

I still maintain that for some Coastal Command aircraft with a ceiling of only 15,000ft, there is no alternative in cu-nim areas but to fly below the cloud-base and risk the water-spouts. Any other height which the aircraft is capable of reaching is still well in the danger belt.

CHARLES GARDNER,
London, W.1. B.B.C. Air Correspondent.

Agile Ancient

YOUR references (in "The Balliol Adopted" in *Flight* of February 23rd) to the extraordinary manœuvrability of the early Boulton Paul twin-engined biplane bombers—the best known of which was, of course, the Sidestrand—recalled to me the astonishing performances by Capt. Courtney (of "the magic hands") on one of the first Bourges. On one occasion, I recollect, *Flight* had a photographer aboard the aircraft, and he was able to secure a memorable series of pictures, including, if I am not mistaken, one taken in a spin. Simultaneously the Bourges was being photographed from another machine.

All this must have happened fully thirty years ago, and no longer having my *Flights* of the period, I (and, I have no doubt, many of the younger generation) would be greatly obliged if you would republish one of the pictures of this frisky old war-horse in action.

ALFRED JENKINS.
Salford, Lancs.

[*Flight*'s art editor, John Yoxall, who was the photographer on the occasion recalled by our correspondent, writes: "The photograph in question was taken in June, 1919, over Hendon airfield during a special meeting held to welcome the American, Cdr. Read, who had just flown the Atlantic in the N.C.4. I was in the Bourges endeavouring to obtain photographic impressions of aerobatics in a twin-engined aircraft, while another *Flight* photographer in, I think, a D.H.9, pursued a steadier way and pictured the Bourges as it performed." A photograph is reproduced on this page.—ED].

Giants of the Past

HAVING read Geoffrey Dorman's historic survey (*Flight*, February 9th) of the growth in size of aircraft through the years, I would remark upon certain inaccuracies concerning the first of the four-engined Handley Page V/1500 aircraft.

The first flight of this remarkable machine was made from a small grass airfield at Cricklewood in early 1918, and not 1917, as stated. The crew consisted of a charming young captain of the R.F.C. named Busby, Hathaway of the Beatty School of Flying (which had ceased operations after Stanley Cownie had killed himself by "spinning in" on the little Beatty single-seater), and the writer. To say that at least one of the crew of three had some qualms about the first take-off is a masterly understatement.

We made a number of tests during the few weeks following upon the first flight, on one of which we were accompanied by the indefatigable General (later Sir Sefton) Brancker.

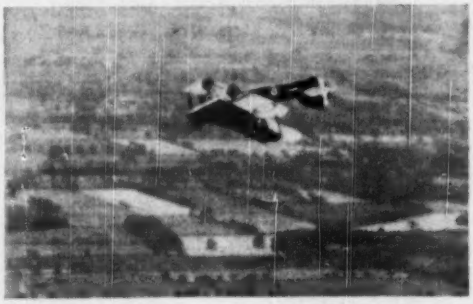
Then the aircraft was taken into the flight shed in order to carry out modifications designed to eradicate peculiarities in control response. During this period I was posted to a unit of No. 7 Wing in the newly formed R.A.F., and thus took no further part in the proceedings.

When next the V/1500 was flown, Busby and Hathaway were accompanied by four passengers, one of whom was Col. Ogilvie, who was seated in the gunner's cockpit at the tail end of the fuselage—a feature of design which was introduced by this aircraft for the first time in history. Col. Ogilvie survived by reason of being so positioned, for on this flight the aircraft crashed and was completely burnt out.

It was not until the second aircraft was ready for flight that Clifford Prodger was engaged as pilot. It is true that he was a "free-lance" pilot, but by no means the first.

From then on, production of the V/1500 was accelerated, and when the Armistice was declared, a squadron of them was forming at Bircham Newton with a view to raiding Berlin, but the suspension of hostilities prevented the fruition of this project.

FRANCIS A. KAPPEY, A.F.R.Ae.S.
Gurnard, I.o.W.



Bourges on its back (see "Agile Ancient" in column one).

GEOFFREY DORMAN'S article "Size is Relative" made most interesting reading. With all respect to your contributor, however, I should like to submit the following corrections and additions to his remarks concerning Igor Sikorsky's *Ilia Mourometz*.

First, the name is that of a legendary Russian hero, and not of a Biblical prophet. The wing area of the first machine was, of course, a mere 1,700 sq ft. Mr. Dorman is incorrect in saying that the outbreak of war in August, 1914, prevented further development of the type; altogether about 75 of the machines were built, and were widely used on the Eastern Front as bombers during the war by a specially formed unit, "The Squadron of Flying Ships." Each machine was a slight improvement on its predecessors, chiefly in respect of armament and engines. In fact, your photograph shows *Ilia Mourometz E*, which had four 220 h.p. Renault engines.

Whilst I realize that the range of such an article is necessarily limited, surely it was unfair to terminate the Sikorsky genealogy so abruptly? Obviously, experience gained with the *Mourometz* played a large part in the development of the huge trimotor S-35, built in America in 1926 for Captain René Fonck's unsuccessful New York to Paris flight. The line can also be traced down through the Sikorsky amphibians to the transoceanic flying-boats.

The facts given herein are taken from Sikorsky's autobiography, *The Story of the Winged S*. One further point: surely the *Maxim Gorki* was the ANT-20, and not, as stated, the ANT-13?

JOHN M. HOULDING.

[The original *Maxim Gorki*, mentioned by our contributor, was the ANT-15. The designation ANT-20 was applied to its successors, which were to have six 1,200 h.p. engines instead of eight of 750 h.p. Nothing more was heard of the venture after A. N. Toupolev, the designer, was "liquidated" in 1938.—ED.]

The Beech T-34

WE note with interest the comments of your contributor Mr. Stanley H. Evans on the Beech T-34 on page 800 of the December 22nd, 1949, issue of *Flight*.

At the outset our goal was to construct a two-place, tandem trainer using the Bonanza power plant, landing gear, and as much of the basic design and tooling as possible. As a result of this policy the type of interchangeability which has been achieved in the T-34 programme is "manufacturing and facility" interchangeability. Many of the components of the two airplanes are physically interchangeable, yet obviously

there would be no advantage in ever doing so. For example, the T-34 wing will install in a Bonanza, but a weight penalty occurs. Conversely, a Bonanza wing will install in a T-34 but it isn't quite structurally adequate. The wings of the T-34 are those of the A-35 or B-35 Bonanza strengthened by means of increasing the material gauges of certain elements and resorting to higher-strength alloys for the wing fittings. This is not as big a step as it may first appear, since the basic Bonanza wing is capable of supporting a static load corresponding to 8.5 *g*.

Even the fuselage is much more closely related to the Bonanza than you might imagine. From the firewall forward the external configuration is identical. Internally, the only differences are in material gauges of certain elements and the addition of a few skin-support formers. Aft of the firewall in the cockpit section the greatest differences must naturally occur. Even here, however, the wing beam carry-through structure is the same as that of the Bonanza except for gauge increases and minor reinforcements. Since the same carry-through structure is used, it follows that the maximum fuselage width of the T-34 is identical to that of the Bonanza. This is perhaps one of the very few instances in aviation history in which a wide, roomy, two-abreast cabin was converted into a tandem cockpit arrangement. Even so, by the time all of the desired console installations were made, the fuselage was none too wide.

Aft of the cockpit section the external configuration of the fuselage is again identical to that of the Bonanza. The internal structure of this section is the same as in the Bonanza except in the extreme aft region, where it was necessary to rearrange the bulkheads to accommodate the conventional tail. The tail-cone fairing is a Bonanza stock item.

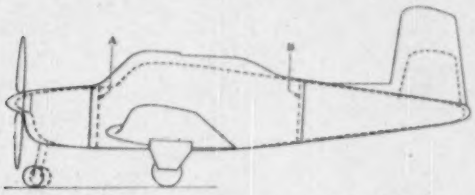
In the tail group there is also more of the Bonanza than meets the eye. The horizontal tail group is a Bonanza vee-tail swung down to zero dihedral. The vertical fixed surface is a Bonanza fixed surface shortened a few inches. It is true, however, that the type of construction employed in the T-34 tail group has never been production-released for the Bonanza.

The landing gear assemblies are "beefed up" to meet trainer requirements, but the installation dimensions are the same as for the Bonanza. With the exception of a 5-in extension in length of the link rod which actuates the nose-gear retraction linkage, the electrically operated landing gear retraction system is lifted in its entirety from the Bonanza.

We trust that this and the sketch enclosed herewith [reproduced below.—ED.] may serve better to establish the relationship of the T-34 to the Bonanza, as these two aircraft are indeed blood relatives.

HERB DICKARD,
Preliminary Design,
Beech Aircraft Corporation.
Wichita,
Kansas.

[Mr. Dickard's comments relate to the opinion, expressed by our contributor, that "In view of the fact that even a primary trainer would have to be designed for aerobatic load factors, it is a bit difficult to see how much of the structure could be interchangeable between the two types, other than detail fittings and assemblies perhaps."—ED.]



T-34 and Bonanza (dotted) compared. If the Bonanza's firewall (A) were moved 5in forward it would register will that of the T-34; the rear bulkhead (B) would coincide if moved 3in aft.

For Single-seat Solos

WE were interested to read Mr. Cooper's letter in your issue of February 9th, concerning single-seat solos and, in particular, the Chilton. The interest shown by him and other people in this aircraft is much appreciated.

It did not appear to us after the war that production of this machine or, indeed, any light aircraft was likely to prove a financial proposition, and with much regret its revival was postponed. We are glad to say, however, that the College of Aeronautical Engineering have taken over all drawings (which were not lost, but were not edited for submission to outside firms) and are preparing a machine for A.R.B. approval. When this is obtained it is hoped that the drawings will be available to all interested parties.

A. R. WARD, Managing Director.
Hungerford, Berks. Chilton Aircraft Co., Ltd.

FORTHCOMING EVENTS

March 4. British Interplanetary Society: "Testing of Rocket Motors," by Dipl. Ing. H. F. Zumpe.
March 7. R.Ae.S. Graduates: "Gas-turbine Installation," by J. C. Wallin, B.Sc., A.F.R.Ae.S.
March 8. R.Ae.C.: Ball, Londonderry House.
March 9. R.Ae.S. (Isle of Wight): "High-speed Research," by J. D. Derry.
March 10. R.Ae.S. (Portsmouth): "Design Problems of Large Flying Boats," by H. Knowler, F.R.Ae.S., A.M.I.C.E.
March 13. R.Ae.C.: Film Show, Londonderry House.
March 14. Aero Golfing Society: Match v. R.A.F.G.S., followed by *Flight* Dinner.
March 14. R.Ae.S. (Belfast): "Problems of High-speed Flight," by H. Davies, M.Sc., F.R.Ae.S.
March 15. R.Ae.S. (Coventry): "Flying Boats," by H. Knowler, F.R.Ae.S., A.M.I.C.E.
March 16. R.Ae.S.: "Air Survey," by Prof. C. A. Hart, M.Sc.(Eng.), Ph.D., M.Inst.C.E., F.R.I.C.S.
March 17. Institute of Transport: Annual Dinner.
March 21. R.Ae.S. Section Lecture: "Boundary Layer at High Speeds," by A. D. Young, M.A., F.R.Ae.S.
March 22. R.Ae.S. (Manchester): "Accident Investigation," by A. Cdre. Vernon Brown, C.B., O.B.E., M.A., F.R.Ae.S.
March 23. R.Ae.S. (Glasgow): "Fuel Consumption," by J. Lozzaec.
March 23. R.Ae.S. (Isle of Wight): "Gliding," by P. A. Wills, C.B.E.
March 24. College of Aeronautics Senior Common Room Society: Annual Dinner.
March 25. Helicopter Association: "Performance Testing of Helicopters," by P. O'Hara, M.A.
March 27. R.Ae.S. (Bristol): "Gliding," by A. H. Yates, B.Sc., A.F.R.Ae.S.
March 28. Institute of Transport (Metropolitan Graduates): "Post-war R.A.F. Developments and their Effects on Civil Aviation," by A. J. Allum.
March 28. R.Ae.S. Graduates: "Undercarriage Design and Testing," by G. S. Cranwell, Grad. R.Ae.S.
Mar. 28-31. Royal Meteorological Society: Symposium, Oxford.
March 29. R.Ae.S. (Gloucester and Cheltenham): "Aircraft Materials and Processing," by Dr. H. Sutton, D.Sc., F.R.Ae.S., F.I.M. (at Gloucester).
March 30. R.Ae.S.: "Testing Aero Engines and Power Plants," by A. C. Lovesey, O.B.E., B.Sc., F.R.Ae.S.
April 1. British Interplanetary Society: "Space Travel—Fact and Fiction," by A. C. Clarke, B.Sc.
April 3. Institute of Transport: Brancker Memorial Lecture—A.V.-M. D. C. T. Bennett, C.B., C.B.E., D.S.O.
April 4. R.Ae.C.: Film Show, Londonderry House.
April 4. R.Ae.S. (Belfast): Annual General Meeting.
April 5. R.A.F. Golfing Society: Match v. Greyhound Racing Association.
April 5. R.Ae.S. (Bristol): "Aircraft Production and Engineering," by Prof. J. V. Connolly, B.E., A.F.R.Ae.S.
April 5. R.Ae.S. (Slough): "Flying-boat Design Problems," by H. Knowler, A.M.I.C.E., F.R.Ae.S.
April 7. R.Ae.S. (Portsmouth): "Aircraft in Future Warfare," by Air Marshal Sir Robert Saundby, K.B.E., C.B., M.C., D.F.C., A.F.C.
April 7-10. Association of British Aero Clubs: Easter "Aerocade."
April 8. British Interplanetary Society (Manchester): Film Show.
April 12. R.Ae.S. (Reading): "Flying Boats," by H. Knowler, F.R.Ae.S.
April 13. R.Ae.S.: "The Berlin Air Lift," by A. Cdre. J. W. F. Merer, C.B.
April 13. Guild of Air Pilots and Air Navigators: Annual General Meeting.
April 18. Aero Golfing Society: Instone Cup Meeting.
April 18. Institute of Transport: Informal Luncheon. Speaker: Sir Miles Thomas, D.F.C.
April 18. R.Ae.S. Graduates: "Training of Aeronautical Engineers." (Discussion; chairman, Marcus Langley, F.R.Ae.S.)
April 25. R.Ae.S. Section Lecture: "Flight Refuelling and the Problem of Range," by C. H. Latimer Needham, M.Sc., F.R.Ae.S.
April 25. R.Ae.C.: Film Show, Londonderry House.
April 26. R.Ae.S. (Preston): Annual General Meeting.
April 27. R.Ae.S.: "High-speed Research in the Aerodynamics Division of the N.P.L.," by I. A. Beaton, M.A. (Constab.), A.F.R.Ae.S., and D. W. Holder, D.I.C., A.C.G.I., B.Sc. (at Manchester).
May 4. R.Ae.S.: Third Louis Blériot Lecture, by Sir Frederick Handley Page, C.B.E., F.I.Ae.S., Hon. F.R.Ae.S. (in Paris).
May 14. R.Ae.S. Garden Party, White Waltham.
May 19. Bomber Command Night, Royal Albert Hall.
May 20. Northamptonshire Aero Club: At Home.
May 25. R.Ae.S.: 38th Wilbur Wright Memorial Lecture, by Sir Richard Fairey, M.B.E.
June 10-25. Brussels International Aeronautical Exhibition.
June 17. Wolverhampton Aero Club: Wine's Cup Race.
July 7-8. Royal Air Force Display, Farnborough.
July 22. Yorkshire Aeroplane Club: International S.B.A.C. and Air League Cup Races, Sherburn-in-Elmet, Leeds.
July 22-30. Derbyshire and Lancashire Gliding Club: National Gliding Contests.
Aug. 19. Swansea and District Flying Club: Kemsley Trophy Race (International), Fairwood Common, Swansea.
Sept. 2. Coventry Aero Club: Siddeley Challenge Trophy Race, Baginton, Coventry.
Sept. 15. Battle of Britain Day.
Sept. 16. R.A.F. "At Home" Day.

THE HOME-BUILT AIRCRAFT

Its History at Home and Abroad: the Discouraging Position To-day

By A. R. Weyl, F.R.Ae.S.

IN view of the sorry state of private flying in Britain, the construction of aircraft by enthusiastic amateurs is frequently discussed. The following notes form a brief survey of experience and evidence collected in past years, and one from which, it is hoped, the reader may form his own opinion as to whether such amateur activities are desirable. Those who are personally interested in construction are referred to the Ultra Light Aircraft Association* which exists to promote and assist amateur aircraft-construction on a sound technical basis.

Many people to-day overlook the fact that aeronautics began with the work of pure amateurs. However learned and professional the present activities of the Royal Aeronautical Society may be, for instance, this ancient institution was founded by amateurs and sustained by them for half a century or so; all these amateurs, moreover, were "cranks" in the eyes of their non-flying contemporaries.

Before one goes deeper into the matter, the term "amateur" needs clarifying. In the first place, it means anyone who is not a professional, however trained or instructed he may be; beyond that, the term implies that the person concerned pursues the activity for its own sake, i.e., not in expectation of remuneration. The name, therefore, does not necessarily imply that the enthusiast in question is ignorant of the matter he has elected to deal with, or that he is incapable of doing so properly. It is such implications which logically lead to the off-hand judgments that are so often passed upon amateur aircraft.

Technical understanding and manual skill are to-day more widely possessed than they were 40-odd years ago. For example, knowledge of the functioning of a four-stroke I.C. engine is no longer restricted to engineering circles, and good craftsmanship is often found among people who earn their living in quite a different way. We are in an age of engineering. The design of aircraft, admittedly, has meanwhile become a refined procedure which calls for a rather high standard of specialized engineering knowledge. The position, in brief, is that whilst the *design* of an aircraft will generally be beyond the scope of an amateur, the *construction* of a simple machine from suitable drawings can be undertaken by genuine amateurs or groups of enthusiasts. The better the design and the building instructions are suited to a low standard of technical knowledge and manual skill, the wider is the circle of potential amateur constructors. The extent to which the amateur can be helped lies, therefore, in the hands of the professional.

Obviously it is necessary to provide special designs for the purpose, and it would be wise to restrict the activities of genuine amateurs to specific types. Such aircraft will, of course, be within the "ultra-light" category; with engines of under 75 h.p.; with a stalling speed of under 40 m.p.h.; and with all-up weight not greater than 1,200 lb. Ease and simplicity of construction are of paramount importance.

One important group of amateur constructors is in an intermediate category between the genuine amateur enthusiast and the professional. To it belong technical schools, aeronautical colleges, constructing groups attached to aircraft firms, club workshops formed at Service establishments, etc. The spade work done by these semi-amateur groups cannot be overestimated. We recall the Cranwell light aircraft to N. Comper's design, and the various novel types built by the de Havilland and Miles Aircraft technical schools, by the R.A.E., by the Halton apprentices. In fairness, however, it must be said that these efforts were more professional than amateur; nor are the activities of this group restricted to the ultra-light category.

To assist appreciation of the specific requirements, former serious attempts in amateur construction may be critically surveyed.

Though not intended for enthusiastic home producers, the ultra-light monoplanes of Santos Dumont and of Hans Grade were among the earliest that attracted the hobbyists; both were small and light, had engines of between 16 and 24 h.p. only, looked immensely simple to construct, and both types impressed one "as very easy to fly. The majority of pre-1914 pilots in Germany learned to fly on the Grade parasol, usually by solo training; and there were only two fatal crashes, in spite of a highly temperamental two-stroke engine and a single-lever control system. Numerous (unlicensed) replicas were built, more or less "improved" to the taste of the enthusiast; most of them flew nicely, as long as the engine permitted.

THE author, who is a well-known designer of light aircraft and sailplanes, and a member of the executive committee of the Ultra Light Aircraft Association, reviews some notable constructional achievements by amateurs in the past. But in Britain to-day, he says, the amateur builder is aviation's Cinderella

The first design specifically intended for amateur constructors seems to have been a neat-looking single-seat biplane designed by C. M. Poulsen, the former editor of *Flight*. The construction, with all necessary calculations, was described in a series of twelve well-illustrated articles published during the first half of 1916. The engine was the 30 h.p. Anzani 3-cylinder (then easily available). The wings, of equal span, had Raf 6 aerofoil section and single-bay bracing. The fuselage was of octagonal cross-section and was well faired. There is, however, no record of an actual construction, doubtless because war-time was hardly propitious.

Home-constructed gliders have been common since the early days of aviation. Hundreds were made to instructions made available by *Flight* and other technical journals. A mighty impetus to amateur construction came with the development of soaring flight in Germany. There, up to about 1932, amateur-built motorless aircraft were the rule rather than the exception. Long before Hitler came to power, such activity had been organized rather well. The first stage was a primitive training glider ("Zoegling"); a somewhat refined training glider followed ("Pruefling"), and finally a real, but simple and robust training sailplane ("Grunau Baby") was constructed. Excellent drawings and instructions were available. The amateur's ultimate achievement was the construction (and perhaps even the design) of a high-performance sailplane for competition flying. Supervision and assistance were given by a central organization of soaring clubs. On the whole the scheme worked amazingly well.

Motor gliders and auxiliary-powered sailplanes were natural offsprings of these purely amateurish activities (which, it must be said in fairness, had no military implications before the arrival of Hitler). Likewise, in this country Lowe-Wylde's Drone was originally the effort of a genuine amateur glider-constructor.

Very soon, wide interest was shown in light aircraft of low cost and simple upkeep. Ways soon parted along two distinct directions: the power-assisted sailplane (or motor glider) and the ultra-light aeroplane.

In France, the enthusiastic De Pischoff proved with his Avionnette and Estaffette that aircraft could be kept

*U.L.A.A. headquarters are at 24, St. George's Square, London, S.W.1.—Ed.

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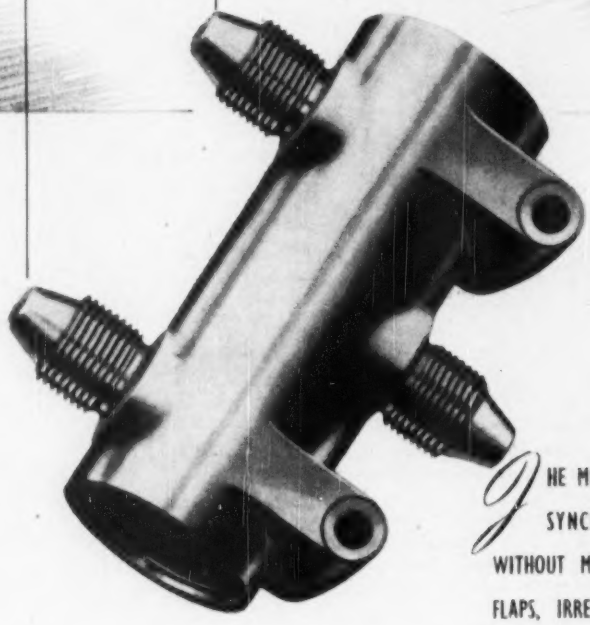

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THE HOME-BUILT AIRCRAFT . . .

so small and simple that anyone could build them at home. Unfortunately, he met with a tragic accident before he could establish a movement on this basis; it was the same fate which was to befall Lowe-Wylde eleven years later.

In Germany, the powered sailplane idea prospered in the hands of the gliding clubs. There were dozens of different designs, all amateur-built; some of them were really practical, but all were grossly hampered by the lack of suitable engines. Even the industry began to take an intelligent interest in this development. The Klemm Works and several other firms developed types which could be bought as kits for assembly and finishing by relatively unskilled amateurs. The supply was, however, restricted to recognized clubs so as to ensure proper inspection. Among the most ardent promoters of amateur-built aircraft was Oskar Ursinus, editor of *Flugsport* and co-founder of the German soaring movement. A. Lippisch and H. Kromer also deserve to be named in this respect.

A typical, though by no means recommendable feat was a 75 h.p. fast two-seater monoplane designed and built by a Berlin tube-railway ticket collector. He also tried his hand at flight-testing this aircraft, without previous experience in flying. The damage done was relatively small.

Pre-war Design Competitions

In 1931, the Association of German Aero Clubs arranged a design competition for a 20 h.p. single-seater, and two parasol monoplanes with braced wings were selected after exhaustive flying tests. The price of the engine (Mercedes twin-cylinder) and of the material was estimated at £150. In the choice of material (pine timber and birch plywood), and in design details, the practice of glider construction was closely followed.

About seven years later, another competition for amateur-built and designed ultra-light aeroplanes was held by the Aero Club of Germany. Eighteen or more different types took part, ranging from miniature racers to large training gliders with engine assistance. This time, the best flying performance was rewarded. True to principles, however, the lone hobbyist was neglected; organized groups alone were encouraged to compete.

In France, in spite of bureaucratic restrictions, an astonishing variety of well-designed and well-built, ultra-light aircraft could be found about ten years before the war. In 1928, Henri Mignet developed a little parasol monoplane, the H.M.8, of conventional layout; after the journal *Les Ailes* had given it publicity, it was adopted by dozens of amateurs. Many H.M.8s were flown, though freely modified to the taste of the builder—which fact, of course, brought an element of danger into the movement. In 1934, Mignet produced the amazing *Pou-Du-Ciel**; publishing his famous book *Le Sport de l'Air*, he made the design a gift to all amateurs. Unfortunately, he had contrived to embody the design in a book of 500 pages (most of which did not deal with the aircraft at all), while no proper drawings were available. This again introduced an element of danger, as the impatient enthusiast, after thumbing the pages many times without discovering the information he wanted, was led to improvise on his own.

With the *Pou*, however, amateur construction became a very popular pastime in France and elsewhere. Even obstinate authorities had to yield in the end, though they were able to feel justified in their earlier attitude when the *Pou* was eventually found aerodynamically lacking and received some unwelcome publicity. Later on, the amateur construction-movement was regularized and canalized. The French Government promoted one or two competitions for ultra-light aircraft, and some of the types developed for these events were undoubtedly "amateur-suitable." On the whole, however, little official encouragement was directly given to the amateur producer.

In the United States, the interest of amateurs in the building of cheap, small aircraft has always been alive. Many of the "barnstormers" of the twenties thus found an interesting occupation. A number of now-well-known aircraft factories grew from genuine amateur efforts, and many firms are still catering for amateur producers. In view of the airworthiness regulations now in force, the supply of ready-made building kits covering approved standard types seems to predominate. Also, the converted motor-car engine is still in favour with beginners. Convenient payment arrangements make it possible even for youngsters of small means to achieve their ambition. As far as can be judged, the authorities view this development with sympathy; rules and regulations seem to be interpreted with common sense.

Soon after the First World War, the British amateur received a raw deal. The few attempts to provide potentially amateur-suitable designs (Koolhoven-BAT; Glenny-Henderson-Pearson; Shackleton and Lee Murray, etc.) soon petered out without meeting very much response. To comply with all regulations, to secure a Certificate of Airworthiness from the Air Ministry; these necessities, with the compulsion to employ certificated ground engineers, made private designs and the operation of ultra-light aircraft virtually hopeless for anyone who was neither wealthy nor professionally active in aeronautics.

The types which had been designed for the two Lympne ultra-light aircraft competitions remained of no use as far as the amateur was concerned. Of no type were drawings and building licences available; none of the firms concerned saw cause to encourage amateur construction. In addition, the only really practical engine, the Bristol Cherub, cost far more than a genuine amateur could afford.

In 1935, under pressure from Sir Adrian Chamier (of the Air League) and others, the Air Ministry relented in its attitude. Full liberty was granted to amateur designers and constructors. It was an admirable action, and it would be a gross distortion of the truth to contend that the results were anything other than frankly encouraging. Exceptionally few accidents occurred; of those which did, nearly all arose from the *Pou* design deficiency, while one involved an expert aircraft designer testing his own ultra-light experiment. There was, clearly, no reason to cast suspicion upon the activities of British amateur constructors. Ignorance and lack of skill may have been present in some of the hobbyists, but no case of real irresponsibility was recorded. Nearly all amateurs intend to fly their own aircraft and an enthusiast is rarely suicidally inclined.

Official Obstruction To-day

Among the standardized designs which became popular in this country, were the American Heath Parasol, and G. H. Latimer-Needham's Luton Minor monoplane, both single-seaters of very simple design. A number of such amateur-built aircraft are still in existence. No further constructions of this kind are possible, as these types (as all pre-war ultra-lights of British design) have no Type Certificate of Airworthiness.

To-day, in spite of professed sympathy towards the "little man" in private flying, in spite of all democratic sentiments in favour of a popular flying movement, the amateur constructor in Britain leads a Cinderella existence.

The Helmore Committee made the mistake of demanding the imposition of Certificates of Airworthiness upon ultra-lights of all kinds. The Whitney-Straight (Special Advisory) Committee on Private Flying chose to endorse this, without demanding evidence to show that this was necessary. The Ministry of Civil Aviation had little choice but to adopt these recommendations; it made a laudable effort to soften the blow. The Air Registration Board, too, is still trying to help the "little man." But the harm was done.

In spite of the patient work done by the Ultra Light Aircraft Association [their current progress-report appears on page 283—ED.], the British amateur constructor is in a hopeless position. He cannot afford to embark upon a design of his own; the costs alone would be prohibitive. No "approved" designs are available which he can follow. In fact, an ultra-light aircraft, for which drawings and

* *See article, by the present author, in "Flight" of January 19th 1939.*

THE HOME-BUILT AIRCRAFT . . .

building rights might be made available to the amateur, has as yet achieved a Type Certificate of Airworthiness.

In other words: *No amateur constructor in this country is legally in the position to build an aircraft!*

He may, of course, build anything he fancies, but as soon as he tries to fly it—even round an airfield and as a qualified pilot—he (or any pilot) would be prevented by law. That is the sorry state the British aeronautical enthusiast has reached five years after winning the Second World War!

Those few enthusiasts who still persist under such hopeless conditions, either turn "illegal," or amuse themselves with the reconditioning of the few pre-war ultra-light aircraft which, by special grace, have a "Permit to Fly."

How much luckier is the amateur in France! There, too, a *Certificat de Navigabilité* is obligatory. But a resourceful Government office, the Service de l'Aviation Légère et Sportive ("S.A.L.S.") takes care of the amateur constructor. Amateur-suitable aircraft types are developed to the order of this Government office; recognized local clubs are helped with engines, materials and accessories, besides getting petrol at greatly reduced price. Amateurs with designs of their own are assisted, provided that the design is sound. At the moment, S.A.L.S. has on order six ultra-light two-seaters (with 45/50 h.p. Salmson nine-cylinder radials) from three different *private* constructors. On the basis of these designs, standard drawings will be available to any amateur together with the Salmson engine. In addition, 75 h.p. two-seater prototypes of ultra-light two-seaters will serve the requirements of club workshops qualified to construct advanced aircraft.

And in Britain, the problem is: Shall the amateur constructor be exterminated, or shall he be allowed to exist?

AIRCRAFT, DOLLARS and CUTS

An Assessment of Recent Developments

A PERTINENT analysis of the situation being caused in the British aircraft industry by the recent cancellation of Government orders, and by purchases of American aircraft, has been made by an industrial investigator.

Fifty-four million pounds of civil and military aircraft, he says, are coming to Britain from North America, and this means 54,000 man-years of employment in American factories instead of here. He makes the following calculations:—

(A) Civil Aviation

(1) Since the end of the war the value of civil aircraft imported (directly or indirectly) from North America is made up of: 6 Constellations by B.O.A.C. (£1,240,000); 5 Constellations by B.O.A.C. from Eire (£1,575,000); 4 Stratocruisers by B.O.A.C. from S.A.S. (£3,000,000); 6 Stratocruisers by B.O.A.C. (£3,058,800 and 22 Canadair 4s by B.O.A.C. (£4,620,000). Total £13,493,800

(2) Spares, etc., imported from the U.S.A. in 1949 (official customs figures) exceeded £3M. Since the war they cannot have been less than £5,000,000

Total dollar expenditure on civil aircraft £18,493,800

(B) Military Aviation

(1) Under the Mutual Defence Assistance Agreement, Britain is to receive 70 Boeing B-29s with spares and handling equipment. Taking the all-up weight at 130,000lb and reckoning at £2 10s per lb weight, the cost of 70 equivalent British aircraft would have been .. £22,750,000

(2) The development of a British equivalent would have cost about £5M and spares will be worth about £5-£10M. In round figures this totals £12,500,000

Total equivalent expenditure on bomber aircraft .. £35,250,000

Recapitulation

Total dollar expenditure since the war on civil types £18,493,800

Military equipment—estimated expenditure on U.S. bombers £35,250,000

Total £53,743,800

Labour Conversion.—The Times and *The Economist* reckon that production per employee year is £1,000. This is calculated on employees in factories making complete airframes and aircraft engines, airscrews and undercarriages. If the work were sub-contracted, then production per head would be less and hence the number of jobs would be *greater*. It can be assumed therefore that £54 M. means 54,000 employee years.

Labour Conversion on Defence Cuts.—The Economist (February 11th) says: "The reduced orders (announced 27/1/50) are the direct results of the cuts of £30 M. which were ordered to be made in Defence expenditure (following on devaluation) . . . . the cuts to be made by the Air Ministry should not exceed £7-£8 M. Some of these economies will presumably be made by reducing the size and therefore the running costs of Transport Command, but there has to be some reduction in the number of new aircraft ordered. The calculation has been made that 1,000 might become redundant for every million pounds of orders cancelled."

Assuming that £6 M. is to be cut this year from direct aircraft production, then 6,000 employees are affected this year (production of £1,000 per employee year). A cross-check can be made by the Cricklewood shop stewards' estimate of 2,000 dismissals from Handley Page, Ltd. (*The Times*, February 11th)—one-third of the total involved.

DESIGN FOR MAINTENANCE

THIS evening, March 2nd, at the Institution of Civil Engineers, Great George St., London, at 6 p.m., Mr. R. E. Bishop, C.B.E., F.R.Ae.S. (chief designer and director, de Havilland Aircraft Co., Ltd.), will read before the Royal Aeronautical Society a paper entitled "Design for Maintenance."

In Mr. Bishop's opinion "there is nothing new in attempting to design an aircraft to give trouble-free service. This has always been one of the major parts of a designer's job. I would suggest," he states, "that if aircraft have become too difficult to maintain, it is not entirely due to lack of appreciation of the problem in the drawing office, but mainly to the great increase of complexity of the modern aircraft. A great deal of this complication is due to equipment and automatic gadgetry. The remedy rests, to a large extent, with the people who specify this equipment, and, to some extent, with the designer, who seems to have been far too willing to accept any 'requirement' without first satisfying himself that it is in the best interests of the aeroplane as a whole."

Mr. Bishop will treat his subject under such headings as: Drawing-office outlook; liaison with the operator during design; differences between military and civil aircraft; and design features affecting serviceability of transport aircraft. He has reached the conclusion that the latest civil transports have been allowed to become too elaborate, partly owing to the demands of operators and partly to the frightful complexity of the modern high-powered piston engine. The best hope for the future, he believes, seems to lie in simpler aircraft with reliable and well-tested equipment and, above all, in the use of the robust and simple gas turbine.

THE EASTCHURCH MEMORIAL PROJECT

IT may be recalled that in the Correspondence columns of *Flight* for September 1st, 1949, the suggestion was put forward by W/C. W. E. James that readers might be interested in a project to establish an appropriate memorial to Eastchurch, in the Isle of Sheppey, which was a cradle of British aviation and saw the earliest constructors' efforts.

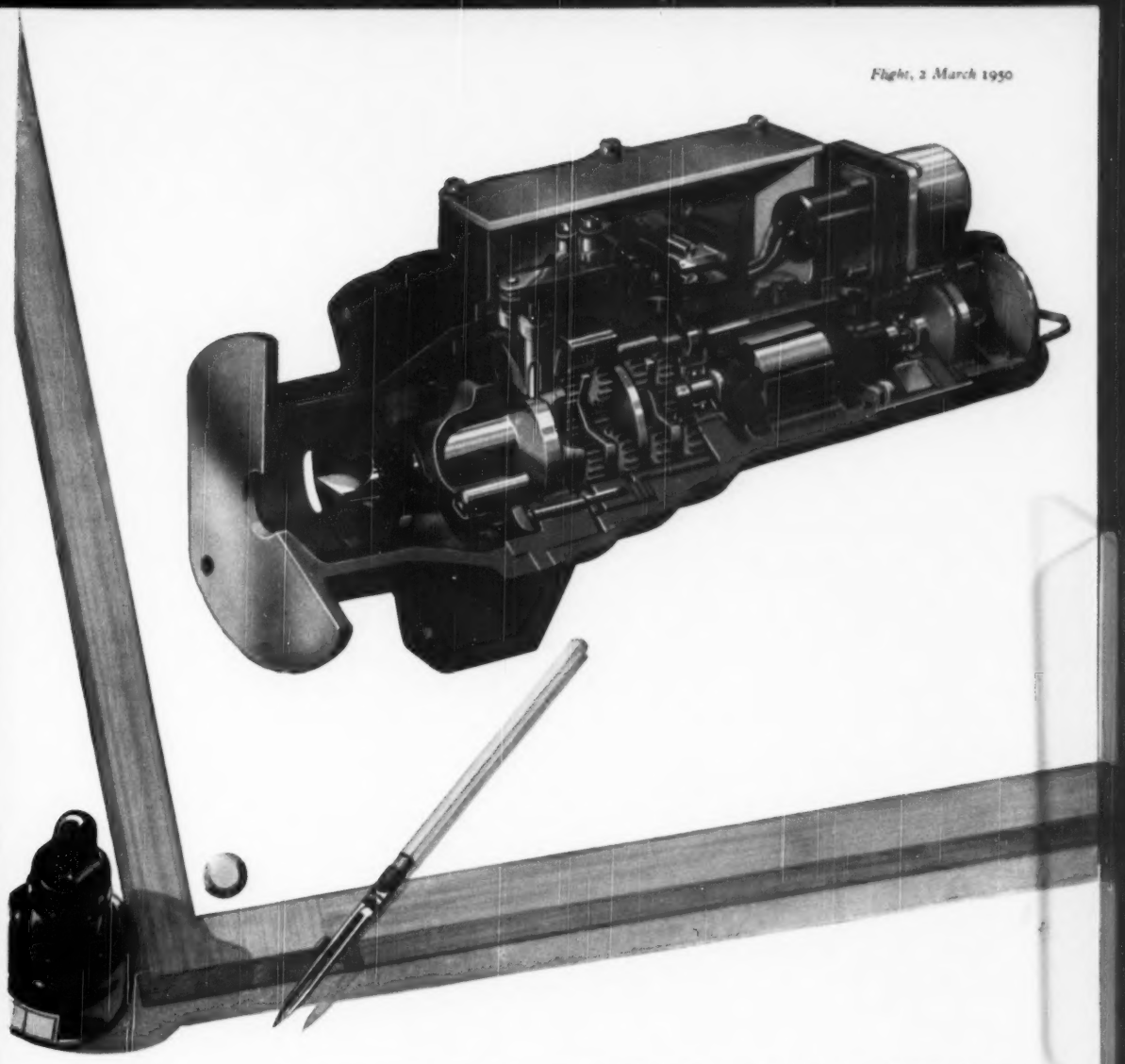
It was suggested that the memorial might take the form of an aeronautical library and museum in a room attached to the proposed village hall, which is to be built as soon as restrictions on such buildings are lifted.

Now the project has again been mentioned, in a letter to *The Times* of February 11th, signed by Mr. Winston Churchill, Lord Brabazon and Mr. Oswald Short. There it is stated that the nucleus of a collection has already been promised by Sheppey residents, but to make the memorial worthy of its object it is hoped that other individuals or bodies may contribute suitable objects. What are specially required are photographs, models or literature associated with heavier-than-air flying of the period 1908-11 and of local interest.

Contributions towards the cost of the project would also be welcome, and should be sent to W/C. W. E. James, Rural District Council Offices, Minster, Sheppey, Kent.

PROFITS AND LOSSES

IN "Views of the Liberals," under the heading "Aviation and the Election" last week, a plus sign was inadvertently omitted from the B.S.A.A. profit figures quoted; the other sums mentioned were, of course, losses.



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Regimental Inspection

AIR VICE-MARSHAL H. T. LYDFORD, Commandant General of the R.A.F. Regiment, last week began a 16,000-mile tour by air of R.A.F. Regiment units in the Far and Middle East. The tour, which will last a month, includes inspections of the R.A.F. Regiment, Malaya, the R.A.F. Levies, Iraq, and the Aden Protectorate Levies.

B.A.F.O. Airwomen

SINCE the Women's Royal Air Force was formed on February 1st last year, 89.5 per cent of the airwomen serving with the British Air Forces of Occupation in Germany have transferred to it from the Women's Auxiliary Air Force and are now serving on Regular engagements. At Headquarters, No. 2 Group, and at three other B.A.F.O. stations all the airwomen have signed on in the W.R.A.F.

Scotland to Sylt

NUMBER 612 (County of Aberdeen) and No. 602 (City of Glasgow)—two of the four Scottish auxiliary squadrons from No. 12 Group Fighter Command—will spend their summer camp this year on the island of Sylt, a few miles off the north-west coast of Germany. The camp will be held from July 15th to July 29th. Ground and air crews of No. 612 Squadron will travel by air from Dyce, near Aberdeen. The pilots will fly their own Spitfires, while the ground crews will go by air transport.

Easter Camp

MANY members of No. 3617 (County of Hampshire) Fighter Control Unit, Royal Auxiliary Air Force, are too busy in the summer months to join a summer camp, and arrangements have therefore been made for them to do their 14 days' annual training during Easter. The unit is to visit R.A.F. Station, Manston, Kent, from April 1st to 15th to carry out "live" interceptions, practice raid reporting and receive instruction in the latest techniques, under regular R.A.F. instructors.

While Parents Watch

A MOST successful experiment has been made at the R.A.F. Administrative Apprentice Training School, R.A.F. Station, St. Athan, Glamorgan, in providing accommodation for parents of apprentices undergoing training. Parents have been invited to visit the school to see the conditions under which their sons live and the kind of training they receive, and to discuss with the Commanding Officer their prospects in the Service. So far, the parents of 100 apprentices have availed themselves of the opportunity of visiting the school and have stayed there for periods varying between a week-end and a fortnight.

R.A.F. Appointments

THE Air Ministry announces the following Royal Air Force appointments, with effect from February 20th:

A.V-M. Lawrence Darvall, C.B., M.C., to be Air Officer Commanding No. 23 Group, Flying Training Command.

A.V-M. Arthur Percy Ledger, C.B.E., to be Air Officer-in-Charge of Administration, Flying Training Command.

It is also announced that A.V-M. Francis Joseph Fressanges, C.B., has left the United Kingdom to take up the appointment of Air Officer Commanding British Forces, Aden, in March.

A.V-M. Darvall has been Air Officer in Charge of Administration, Flying Training Command, since January, 1949, and was formerly A.O.C., No. 3 Group, Bomber Command, from March, 1947. Previously he was A.O.C., Italy, where he went in June, 1946, after commanding No. 216 (Transport) Group in the Middle East for a year. He commanded No. 46 Group, Transport Command, in 1944-45, and was previously Director of Air Transport Policy and Operations at the Air Ministry from April, 1943. Earlier in the war he was Deputy Senior Air Staff Officer at Air Headquarters, India, an appointment he took up in March, 1942, after having been on special duties in the Far East from October, 1940.

A.V-M. Ledger has been Air Officer Commanding, No. 23 Group, Flying Training Command, since February, 1947. He formerly commanded No. 28 Group, Technical Training Command, from June, 1946, and for five months previously commanded No. 54 Group, Flying Training Command. From February, 1942, until January, 1946, he was at the Air Ministry, first as Deputy Director of Ground Defence and afterwards as Director, and he was formerly an administrative staff officer at Air Headquarters, India.

A.V-M. Fressanges, who was promoted to his present rank on January 1st, spent last year as a student at the Imperial Defence College and was formerly Director of Operations at the Air Ministry, a post he took up in June, 1949, after commanding No. 47 Group, Transport Command.

At the outbreak of the war he was at the Air Ministry, as a Wing Commander in the Directorate of Training. In January, 1940, he was given command of No. 210 Squadron in Coastal Command, and in the following year went to the U.S.A. on flying-boat training duties. Returning to the Air Ministry in September, 1941, he served in the Directorate of Naval Co-operation and later in the Directorate of Overseas Operations, of which he became Director, with the acting rank of Air Commodore, in December, 1943. In June, 1944, he was

SERVICE AVIATION . . .

appointed Air Officer Commanding, No. 116 Wing, Transport Command, and in the following year took over command of No. 47 Group.

R.N.V.R. Ratings

THE recruitment of maintenance ratings for R.N.V.R. Air Squadrons, which has previously been confined to men who have already served in the Naval Aviation Branch, has now been extended to include youths between the ages of 17 and 17½ years. They will be entered as Junior Naval Airmen and Junior Air Electrical ratings into the four R.N.V.R. Squadrons based at the R.N. Stations at Abbotsinch, near Glasgow; Bramcote, Warwickshire; Stretton, Lancs; and Culham, Berkshire.

National Service Openings

OPPORTUNITIES of obtaining commissions or of training as pilots in the Royal Air Force are open to many of the young men who will be registering for National Service on March 4th. There are 700 vacancies for commissions in the R.A.F. and 300 places for training as pilots open to National Service men this year. Some 400 National Service airmen have already been commissioned or are being trained for commissions in the R.A.F. and more than 250 others are training as pilots.

The 700 vacancies for commissions are in the Equipment, Secretarial, Education, Fighter Control and Physical Fitness branches and the R.A.F. Regiment, and are additional to the commissions granted to graduates in the General Duties, Technical, Education, and Airfield Construction branches, and the professional Medical and Dental branches. Of the 300 places for pilot training, 100 are reserved for A.T.C. cadets. National Service pilots are trained up to full "wings" standard and have officer cadet status during the greater part of their training. All those who are suitable are commissioned in the Reserve on finishing their whole-time National Service, and it is a condition of their acceptance for pilot training that at the conclusion of their whole-time National Service they will join the R.A.F.V.R. or the Royal Auxiliary Air Force.

R.A.F. RUGGER: The R.A.F. team which, as described last week, drew (6–6 pts.) with the Navy at Twickenham. The last draw between Navy and R.A.F. was in 1947 (5–5 pts.), and in 1948 and 1949 the R.A.F. won. Since the competition started in 1920 the Navy have won sixteen games and the R.A.F. six. Names of the players are as follows:—(Back Row) W/C. G. R. Howie (R.A.F. Rugby Union Secretary); Mr. S. S. C. Meikle (referee); A/C. R. G. Syrett (Fighter Command); P/O. S. T. H. Wright (Cardington); Cdt. S. D. Little (Wittering); Sgt. T. L. Roberts (St. Athan); A/C. D. H. Phillips (Watnall); P/O. B. N. Phillips (Benson); W/C. S. G. Walker (touch judge). (Centre row) F/L. W. T. Hay (Cranwell); W/C. B. P. Young (Air Ministry); F/L. A. A. Smailes (Brize Norton); S/L. R. H. G. Weyhill (Captain) (Cranwell); F/L. H. K. Ross (Manchester U.A.S.); F/L. R. V. Stirling (Waddington); Cpl. E. E. Rossiter (Sutton Coldfield). (Front row) Cpl. G. R. Tucker (Ternhill); F/L. R. G. H. Uprichard (Hildenhall). The last-named has since been awarded an Irish cap.

Middle East Rugby

WITH the new Commander-in-Chief, M.E.A.F., Air Marshal Sir John W. Baker, Lady Baker, and many high-ranking officers in the grandstand, R.A.F. Station Ismailia, recently defeated R.A.F. Station Abu Sueir, by 13 points (two goals and a try) to nil, to win the 1950 R.A.F. Canal Zone Inter-Station Rugby Challenge Cup.

Lady Baker presented the cup to the Ismailia captain, Mr. W. C. Williams, a civilian meteorological assistant, who played a magnificent game at scrum-half, and the Air Marshal was introduced to both teams before the game.

TIRPITZ TROPHY: As reported last week, this relic of the German battleship *Tirpitz* has been presented to Bomber Command by Lt.-Gen. Oen, C.-in-C., Royal Norwegian Air Force (centre). With him at the ceremony are seen (right) Air Marshal Sir Hugh Lloyd, A.O.C.-in-C., Bomber Command, and W/C. J. B. Tait, leader of the Lancaster force which sank the *Tirpitz*.

Married Quarters

IN order to supplement married quarters, a new scheme has been introduced, as a temporary measure, whereby the Air Ministry hires furnished houses or flats for occupation by officers or airmen, who pay the same rent as they would for standard married quarters. Suitable properties within 15 miles of the R.A.F. station at which the personnel serve will be hired, the rental covering furniture, rates, water and insurance. Official hiring of accommodation already occupied under private agreement may be considered on expiry of the agreement. Each of the eight Home Commands, and No. 90 Group, has been authorized, as a start, to make 50 hirings.

Hat Trick

SQN. LDR. F. W. GILLHAM, of H.Q., Middle East Air Force, Ismailia, made R.A.F. fencing history in the Moascar Garrison Gymnasium in the Canal Zone of Egypt. Competing in the first R.A.F. individual fencing championships held in the Zone since before the war, he carried off all three titles—foil, epée and sabre—and with them the title of Master-at-Arms, for scoring the highest aggregate number of points in the three weapons. This is believed to be the first time that a R.A.F. fencer has achieved such a feat. At the end of a full day's fencing, in which some 40 men from eight R.A.F. stations competed, S/L. Gillham stepped up to receive three cups and the Master-at-Arms trophy, competed for for the first time in Egypt, from Mrs. Constantine, wife of A/Cdre. H. A. Constantine, Senior Air Staff Officer of No. 205 Group.

Reunion

HEADQUARTERS Bomber Command Association of Officers.—Fifth annual reunion at R.A.F. High Wycombe, Saturday, May 20th. Details from the hon. secretary, H.Q., Bomber Command, R.A.F. High Wycombe, Bucks.

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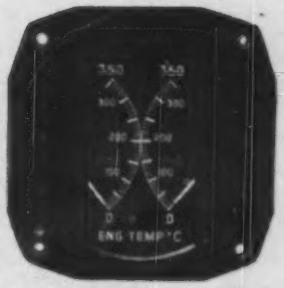

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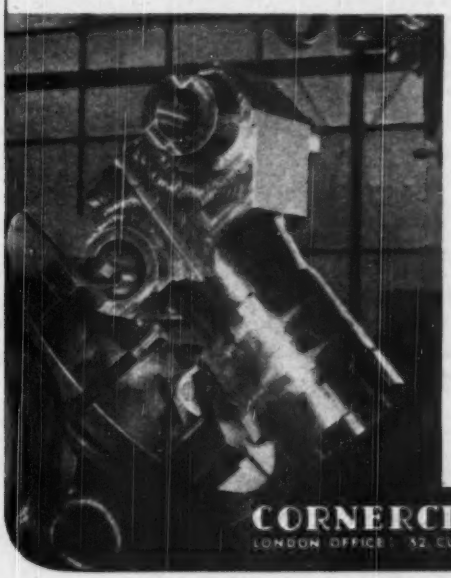

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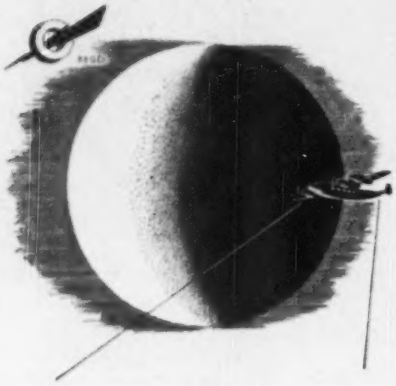

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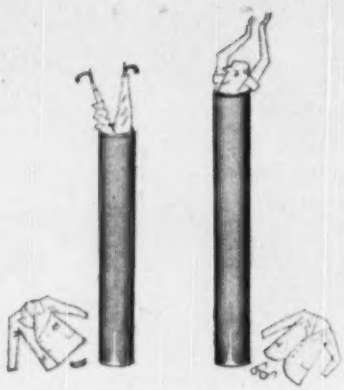

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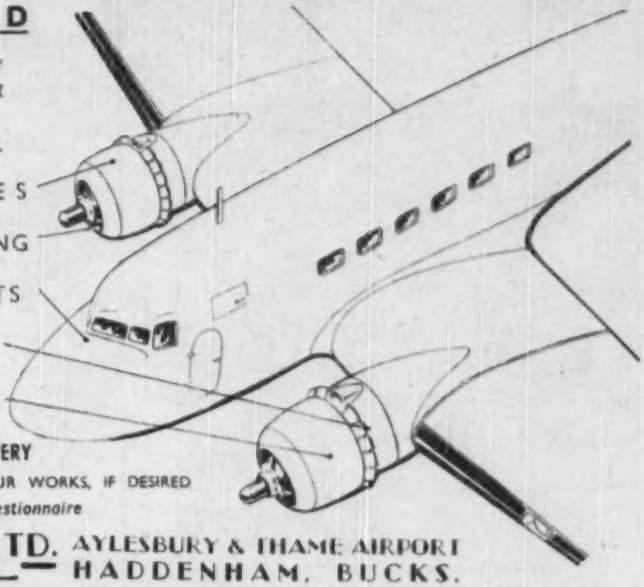

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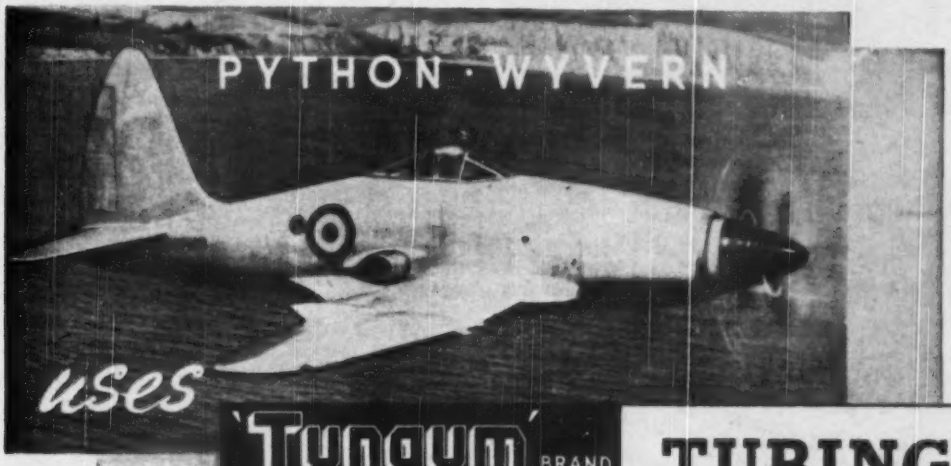

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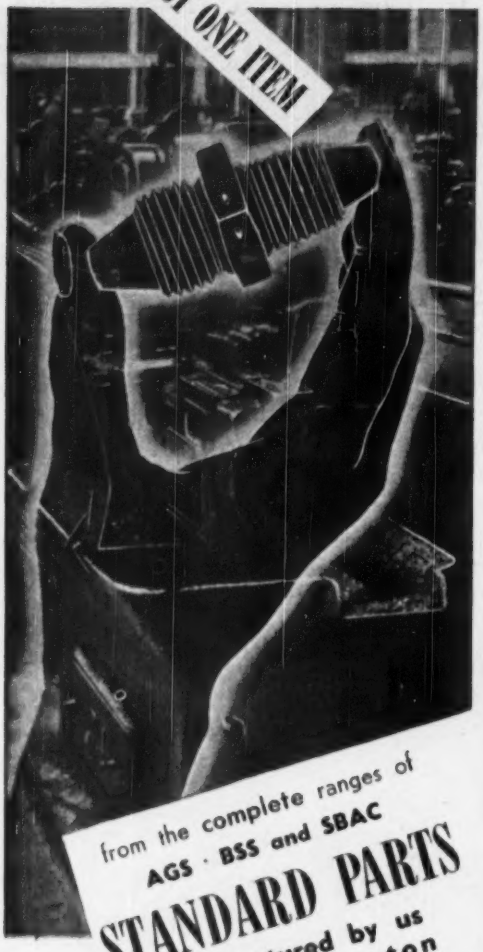

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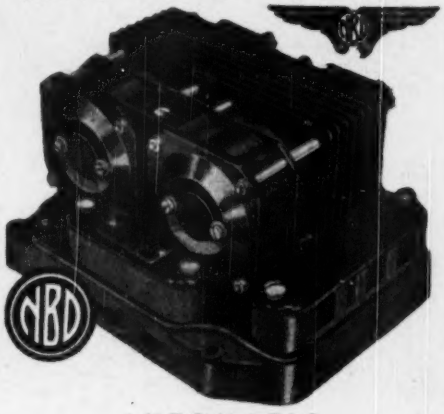

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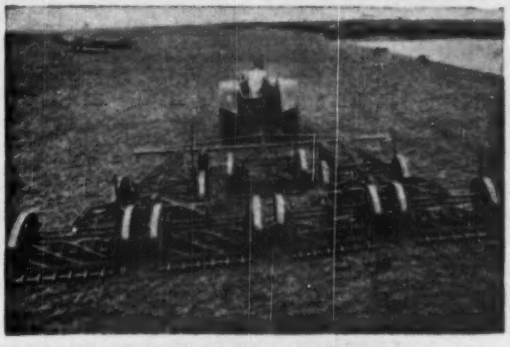

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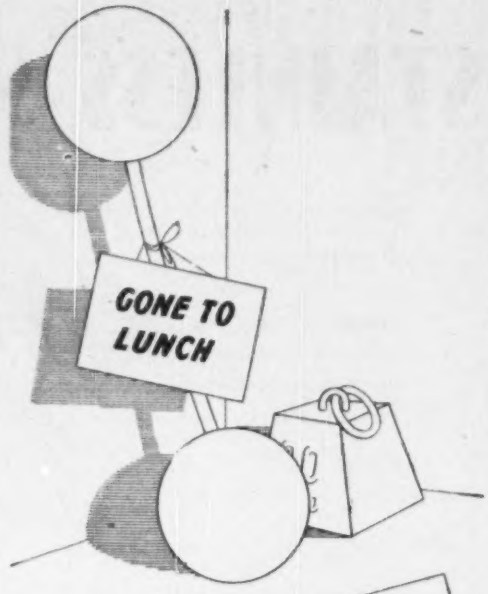

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